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THE ANTARCTIC DISASTER.*

The following is Captain Scott's message to the public found in his diary when the bodies of himself and his two companions, Dr. Wilson and Lieut. Bowers, were discovered by the search party on November 12, 1912:—

CAPTAIN SCOTT'S MESSAGE.

"The causes of this disaster are not due to faulty organization, but to misfortune in all risks which had to be undertaken.

"1. The loss of pony transport in March, 1911, obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.

"2. The weather throughout the outward journey, and especially the long gale in 83° S., stopped us.

"3. The soft snow in the lower reaches of the glacier again reduced the pace.

"We fought these untoward events with a will, and conquered; but it ate into our provisions reserve.

"Every detail of our food supplies, clothing, and depôts made on the interior ice-sheet and on that long stretch of 700 miles to the Pole and back worked out to perfection.

"The advance party would have returned to the glacier in fine form and with a surplus of food but for the astonishing failure of the man whom we least expected to fail.

* Permission has been received from the "Central News" to make use of the information which was cabled to them, and from the proprietors of the *Strand Magazine* to make use of the photographs, which have been taken by Mr. H. G. Ponting, of the five men who perished. The photographs are copyright in the U.S.A.

"Seaman Edgar Evans was thought the strong man of the party, and the Beardmore glacier is not difficult in fine weather.

"But on our return we did not get a single completely fine day. This, with a sick companion, enormously increased our anxieties.

"I have said elsewhere we got into frightfully rough ice, and Edgar Evans received a concussion of the brain.

"He died a natural death, but left us a shaken party, with the season unduly advanced.

"But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier.

"I maintain that our arrangements for returning were quite adequate, and that no **one in the world would have expected the temperature and surface which we encountered at this time of the year.** On the summit, in lat. 35° to lat. 86° we had minus 20° to minus 30°. On the Barrier, in lat. 82°, 10,000 feet lower, we had minus 30° in the day and minus 47° at night pretty regularly, with a continuous head wind during our day marches.

"It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause.

"I do not think human beings ever came through such a month as we have come through, and we should have got through in spite of the weather but for the sickening of a second companion, Captain Oates, and **a shortage of fuel in our depôts for which I cannot account,** and, finally, but for the storm which has fallen on us within eleven miles of our depôt, at which we hoped to secure the final supplies.

"Surely misfortune could scarcely have exceeded this last blow.

"We arrived within 11 miles of our old 'One Ton' camp with fuel for one hot meal and food for two days.

"For four days we have been unable to leave the tent, a gale blowing about us.

"**We are weak, writing is difficult, but for my own sake I do not regret this journey, which has shown that Englishmen can endure hardship, help one another, and meet death with as great a fortitude as ever in the past.**

"We took risks—we knew we took them.

"Things have come out against us, and therefore we have no cause for complaint, but bow to the will of Providence, determined still to do our best to the last.

"But if we have been willing to give our lives to this enterprise, which is for the honour of our country, I appeal to our countrymen to see that those who depend on us are properly cared for.

"**Had we lived, I should have had a tale to tell of the hardihood, endurance, and courage of my companions which would have stirred the heart of every Englishman.**

"**These rough notes and our dead bodies must tell the tale; but surely, surely, a great, rich country like ours will see that those who are dependent upon us are properly provided for.**

(Signed) "R. SCOTT,
"25th March, 1912."

RECEPTION OF THE NEWS.

On the morning of Monday, February 10, the whole world was startled with the news that a disaster had happened to Captain Scott's expedition. The first news was received in many places with incredulity. Later in the day details arrived which left no room for doubt that an irreparable calamity had befallen the leader of the expedition and his four companions on their return journey after reaching the South Pole. They were starved and frozen to death in their tent, to which they had been confined by a terrible blizzard for some days, within 11 miles of a depôt of food and fuel, and only 150 miles from their headquarters. Elsewhere we publish a summary of the work of the different parties of Captain Scott's expedition up to the date of the disaster.

MEETING OF THE SOCIETY.

On February 10th, when the news reached England, an ordinary meeting of the Society was to have been held, and a paper on the Balkan Peninsula was to have been given by Mr. D. G. Hogarth, but the Council, who met in the afternoon, decided that under the shadow of this calamity the ordinary business of such a meeting could not be proceeded with. It was decided to postpone the meeting, but it was arranged that the chairman of the evening, Mr. Douglas W. Freshfield, Vice-President, should give a brief address with reference to the appalling disaster which had occurred. Mr. Freshfield spoke as follows:—

ADDRESS BY DOUGLAS W. FRESHFIELD, VICE-PRESIDENT.

"We meet under the shadow of a great calamity, perhaps the most grievous that could happen to this Society, assuredly one that will be felt most deeply by all its members. The Council when we met this afternoon considered that in the circumstances it would not be well to send away from

closed doors any Fellows who might have come from a distance. At the same time they believed that it would not be consonant with your feelings to listen to and discuss the paper provided for the evening. Mr. Hogarth himself was very desirous it should be postponed till this day fortnight, the 24th, when he has kindly undertaken to read it.

"To-night, by the wish of the Council, I propose to carry through the formal business of the Meeting—the minutes, and the elections. I shall then briefly give the Meeting such information as we have to hand up to the moment of entering this Hall. I do not propose to move any resolution or votes of condolence. For these the time will come later when I trust the President, who is at present in the country and unwell, may be able to be here. I have one remark to add before calling on the Secretary to read the minutes. The list of elections is a long one. This is due to the fact that we present to you to-night, or, rather, we should present to you, were Sir Roderick Murchison's old custom of bringing every new Fellow up to the Chair still honoured, a bevy of Lady Fellows, the firstfruits of the resolution passed by the recent General Meeting. Among them are some distinguished travellers, one of whom would, we had hoped, have joined in the discussion to-night."

The minutes and elections were then read. Mr. Freshfield continued—

"I now rise to say what little can be said in the presence of the sudden and stunning blow which has come in contradiction of all our confident hopes and anticipations. I am not in a position to give any complete or consecutive account of this great, this most unexpected, and in some ways unexampled disaster. I can only piece together such sad scraps of information as through the courtesy of the *Central News* have been put in my hands.

"You may remember the plan of Captain Scott's intended march from his base camp some 850 miles to the South Pole. Sixteen were to start besides the leader, and at successive stages four were to be dropped, leaving a last four to go on with Captain Scott to the final goal. The party started in November, 1911. They had not returned when the relief ship left the base camp in March, 1912, but were reported as last heard of 150 miles from the Pole, all well and advancing steadily on January 4, 1912.

"Our news of to-day is as follows: On or about January 17 last year, 1912, the advance party, consisting of Captain Scott, Lieut Bowers, Dr. Wilson, Captain Oates, who had charge of the ponies, and Petty-officer Edgar Evans, of the Indian Marine, reached the South Pole. They found there Amundsen's tent and records. On the return journey misfortune dogged them. On February 17 Evans died from the results of physical breakdown aggravated by a fall in descending the Beardmore glacier. Captain Oates succumbed next on March 17. On or about March 20 the survivors, Scott, Bowers, and Wilson, were caught in an

overpowering blizzard about 11 miles from the spot known as 'One Ton Depôt,' where they died in their tent a few days later.

"We have no more to-night. To-morrow, doubtless, the sad story will be made clear. We shall learn how their comrades learnt the fate of the pioneers, and how their records were recovered; for it is evident, from the fact that we hear of their finding Amundsen's records, that their own must have been preserved.

"It is a truism to say that in great adventures of this sort it is always the unexpected that happens. No Arctic or Antarctic party was, I suppose, ever sent out better equipped or better fitted by the gallantry and experience of its members, from Captain Scott downwards, to meet with the ordinary perils of the Poles. But Arctic travel would not be what it is, a training ground for the highest qualities of the British race, if these perils were altogether avoidable. And of all dangers in the region of snow and ice, *experto crede*, there is none so terrible, so overwhelming as the blizzard. Even on European mountains it has counted its victims by the dozens. I lost a friend in the Alps only last summer in such a storm. And we can imagine how these terrors are multiplied a hundredfold on an icy wilderness in the heart of the Antarctic. In these conditions, unless shelter is at hand, human powers, even of the toughest, cannot long maintain a struggle against the malign forces of Nature—the end must come.

"To-night it is too soon to realize what we have lost, to tell the praises of these brave men, to move votes of condolence. Such more formal expressions of our deep regret and our heartfelt sympathy must be left to a later day, when we can speak with fuller knowledge. Mrs. Scott, to whom condolence is in the first place due—of whom we are all thinking at this moment—is on the ocean between South America and New Zealand, on her way, as we believed, to join her husband. All I can say to-night, and in doing so I feel I am giving voice to the feelings of every one present in this Hall, is Farewell to a band of heroes whose names will shine as examples of that endurance which is the highest form of courage, and as a noble evidence of the qualities of Englishmen.

"Not once or twice in our rough island story have these qualities been shown, and never more conspicuously than by the members of this ill-fated expedition. Captain Scott lives in all our minds, and will live in our memories, as an ideal of the English sailor of our age, a man full of scientific zeal and enthusiasm, intellectually gifted as well as brave and resourceful in all emergencies. Nor do his companions deserve less honour. They were all equal in their daring, their fortitude, and their deaths. Of their accomplished work we shall hear hereafter; for the moment we can think only of the price that has been paid for it."

APPEAL FOR SUBSCRIPTIONS: LETTER FROM EARL CURZON OF KEDLESTON.

In response to the touching appeal of Captain Scott in his last message, subscriptions were immediately started in order that what were believed to be his wishes should be carried out. The Antarctic Committee, under the chairmanship of Sir Edgar Speyer, Bart., made an immediate appeal for funds, and this was followed by the *Daily Chronicle* and the *Daily Telegraph*, and on February 14 by an appeal from the Lord Mayor on behalf of a Mansion House Fund. The Royal Geographical Society of course could not keep aloof from a matter in which it was so intimately concerned, and on Saturday, February 15, the following letter from the President appeared in the papers:—

"Sir,—So many questions have been asked of the Royal Geographical Society during the last few days as to the various funds which have been started in connection with the lamentable disaster that has befallen Captain Scott and his brave companions, and as to the part which is being taken by the Society in the matter, that a few words of explanation seem to be called for, both to make clear the present situation and to act as a help to the public, whose generosity only requires some guidance in order to find immediate and abundant outlet.

"These funds are four in number, excluding the appeals that are being made in provincial towns (*e.g.* Liverpool) and in the distant Dominions of the Crown.

"(1) As soon as the terrible news arrived the committee of the Antarctic Exploration Fund (of which the treasurer is Sir Edgar Speyer), issued an appeal to the public to assist them in fulfilling Captain Scott's dying prayer to his countrymen to provide for the families of those who gave up their lives with him, and further to recoup those of the survivors who had voluntarily consented to forego a portion of their pay in the interests of the expedition. To some extent the ground of the appeal will be covered by the contemplated action of the Government, to which I shall presently refer; but the ground is far wider than the public appears to realize; and the committee has undoubtedly a first claim upon the public sympathy.

"(2) There is the fund started with a munificent donation of £2000 by the *Daily Chronicle*—a paper that has honourably distinguished itself in the recent history of Polar exploration. This fund was also designed for the relief of the bereaved families, but is to be handed over to the Antarctic Committee for distribution by them.

"(3) Third is the fund inaugurated by the *Daily Telegraph* to raise a memorial to the heroic dead.

"(4) Fourth is the Mansion House Fund initiated by the Lord Mayor with the main object of providing a national memorial to the deceased—

but accompanied by the statement that any balance will be devoted to the benefit of the relatives and to such objects connected with Captain Scott's expedition as may be deemed suitable.

"Between these various funds, therefore, the public can be at no loss in finding scope for its generosity. But in order that this may be well directed and not diffused, some closer definition may be useful of the objects which they respectively have in view.

"First, as to the provision for the widows and families of the deceased—a claim which will be the first in its appeal to the hearts of every Englishman and Englishwoman, to whom it would be abhorrent that any should suffer from the self-sacrifice of their bread-winners or their beloved.

"His Majesty's Government have already announced their intention, in the case of Captain Scott and Petty-Officer Evans, who belonged to the Royal Navy, to award the same pension as would have been given had these officers been killed in action. This will provide some relief to the widows and children whom they have left. But both in these cases and in the case of other members of the party who were not in the public service, or who have left dependants who would not be covered by the application of such a rule, there will be further just and reasonable claims which it will, I am assured, be the desire of the Government to satisfy.

"Some of these persons are far away and cannot be reached without delay. It is therefore impossible at the present moment to state the exact nature and amount of the assistance that may be required. But I have the highest authority for stating that it is the intention of the Government in the cases to which I have referred to supplement the grants already mentioned by further provision from the national funds. It is their desire to leave the bereaved families in a position where they will not suffer from the cruel loss they have sustained; but before it is fair to expect any explicit statement from them, they will naturally wish to know more of the feelings and wishes of those concerned.

"In these circumstances, if the question be asked whether the provision thus contemplated is likely to be adquate to meet the requirements of the case, the answer is that the public need not in any way stint its generosity in so far as this is directed to personal relief, because it may well be that further funds will be of great use in supplementing the provision, however reasonable, that is made by the State; and if they are not so required, the money will still go to objects scarcely less vital, inasmuch as they are objects directly concerned with the success and solvency of the expedition to which Captain Scott had already pledged his fortune before giving his life.

"The Antarctic Committee will, I believe, before long make a fuller statement of the facts and figures which will be in their possession. But lest the public should be under the illusion that there is little to be found

it should be known at once that even before the question of a memorial is considered a sum that may amount to nearly £30,000 will be needed to meet the outstanding liabilities that have been incurred by the expedition, to relieve the estate of Captain Scott, who had chivalrously pledged a large portion of his own and Mrs. Scott's fortune to the expenses of the venture, and to provide for the adequate publication of the scientific results so laboriously collected and tabulated by him almost up to the last hour of his life. The public will, I am confident, find no better means of expressing its respect for the heroes whom it mourns than by completing the work which they had all but finished, and the cost of which they had hoped to recoup after their return to England by means that are no longer open.

"I earnestly trust, therefore, that large and generous donations may be forthcoming, both to complete and render secure a generous provision for the bereaved families, and also to enable the Antarctic Committee to carry out to the full the purpose for which it was formed. On behalf of the Society which I represent I may add that we are at once paying over to the Committee a sum of £1000 which we had intended to contribute to the further progress of the expedition, and which we hope will assist them in their patriotic task.

"There remains the question of a memorial, for which the Lord Mayor's Fund is primarily designed. What form this should take—whether a national monument in a public place or a memorial in our great metropolitan cathedral, where Wellington and Nelson and so many heroes of the land and sea repose, and where so impressive a service was held this afternoon—it would be premature to discuss. The available sites for public monuments in London are few; nor does our artistic genius invariably find its best expression in masses of marble or bronze. But here, again, a large sum of money is obviously required.

"There is, however, one form of memorial with which the Royal Geographical Society, on whose behalf I here write, would like to associate itself, and which may possibly appeal to a wider public even than our members. Captain Scott was our Gold Medallist; Captain Oates and Dr. Wilson were among our Fellows; we were already contemplating arrangements to give them a triumphant welcome home; the first account of their labours would have been rendered to us.

"In a portion of the ground which we have recently acquired at Lowther Lodge, and on a site fronting the park at Alexandra Gate, I should like to see erected a Scott Memorial Hall, in which the explorers of the future would stand up, as Scott has more than once done, and as Nansen, Peary, and Amundsen have done also, to give an account of their work to the British public. We have all been thrilled by the last and noblest words of the dying man:—

"I do not regret this journey, which has shown that Englishmen can endure hardships, help one another, and meet death with as great a fortitude as ever in the past. We took risks—we knew we took them. Things have come out against us, and therefore we have no cause for complaint, but bow to the will of Providence, determined still to do our duty to the last.

"Might not these words be fitly inscribed over the entrance to such a hall? If the money were forthcoming, and if statuary were not decided upon elsewhere, might not the figures of these five men be amongst its adornments; might not the farewell call to duty of this brave man be read out once a year on the anniversary of his death to the assembled geographers and their friends? Would not a building so erected and named, so decorated and employed, do as much to keep alive the memory and service of these heroes as a score of beds in a hospital or a monumental pile of smoke-begrimed bronze? It would be a hall of meeting dedicated to the propagation of that science to which Scott and his companions yielded up their lives. But it would also be a Temple of Fame dedicated to themselves.

"These, however, are ideas which, it may be thought, will appeal primarily to the Fellows of the Society to which I belong; and if they favour them and are inclined to subscribe to a memorial in some form or other, they may perhaps see fit to earmark their contributions to such a purpose.

"The main thing, however, is that the public should realize that large sums are urgently required, and can be usefully spent, and that they should not hesitate, therefore, to give the rein to an impulse which has been quickened by this tale of mingled heroism and disaster as by no other event in my time.

"When the funds have been contributed it seems certain that a central body will be called for to consider their allocation; and I entertain little doubt that, with the co operation of the Antarctic Committee and the Lord Mayor, a committee will be formed that will carry with it the confidence of the subscribers and the public. Steps are being taken in that direction.

"I am, Sir, yours obediently,

"CURZON OF KEDLESTON."

A meeting was held at the Mansion House on February 19, at which it was unanimously agreed to amalgamate the various funds into a single Lord Mayor's Fund. The Mansion House Committee to deal with the amalgamated funds consists of: The Lord Mayor, Alderman and Under-Sheriff Cooper, Earl Curzon of Kedleston, President of the Royal Geographical Society, Lord Howard de Walden, The Right Hon. Sir Edgar Speyer, Admiral Sir Lewis Beaumont, Sir Archibald Geikie, President of the Royal Society, and Mr. Reginald Smith, K.C. Any Fellow desiring

to ear-mark his contribution to the fund for a special purpose, the President suggested that he should have an opportunity of doing so.

MEMORIAL SERVICE AT ST. PAUL'S CATHEDRAL.

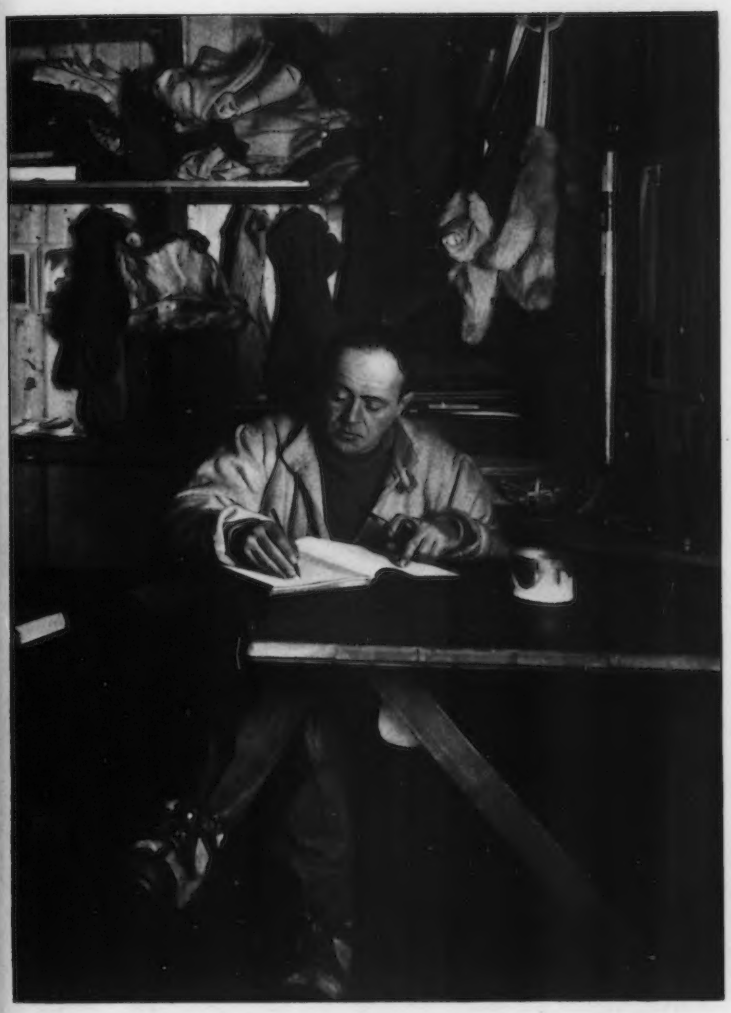
On Friday, February 14, at noon a special Memorial Service was held in St. Paul's Cathedral for those who perished on the expedition. The service was of a most impressive character, and in a special prayer for the occasion the following words were introduced: "We humbly leave in Thy fatherly keeping the souls of our brothers: Robert Falcon Scott; Laurence Edward Grace Oates; Edward Adrien Wilson; Henry Robertson Bowers; Edgar Evans." The Dead March in Saul was played, the organ being supported by the band of the Coldstream Guards. The cathedral was filled to its utmost capacity, and some ten thousand people could not obtain admission. The King was present; several of his Majesty's Ministers; the Lord Mayor in state; representatives of the Dominions; Ambassadors and Ministers of Foreign States; representatives of the Navy and Army, and of societies and institutions of all kinds, besides many distinguished individuals. The Royal Society was represented by Sir Archibald Geikie, the President, and some of his colleagues; the Royal Geographical Society was represented by the President, Earl Curzon of Kedleston, and most of the members of the Council. Mrs. Scott (Captain Scott's mother), sisters and other relatives were present, as well as relatives of the companions who shared his fate.

MEETING OF THE SOCIETY, FEBRUARY 24.

At the ordinary meeting of the Society, on Monday, February 24, the President, Earl Curzon of Kedleston, made the following statement with reference to the disaster:—

ADDRESS BY THE RIGHT HON. EARL CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., PRESIDENT R.G.S.

I CANNOT hope by anything that I may say to add either to the knowledge which the electric telegraph has already given to the whole world of the general circumstances of the Scott disaster, or to the tribute which has been paid to him and his comrades by the press and peoples of England. At the same time you would regard it as wrong if, at the first meeting of this Society after the full tidings have reached us, your President did not say something about a tragedy in which the Royal Geographical Society is most deeply and intimately concerned. Three of those who have lost their lives were our Fellows; the Commander, Captain Scott, had already received both our Gold Medal and a special Antarctic Medal; his first expedition had been sent out under the joint auspices of the Royal Society and



CAPTAIN R. F. SCOTT IN HUT.
(Photo: H. G. Ponting.)

CAPTAIN R. F. SCOTT ON SKI.
(Photo: H. G. Ponting.)

ourselves; we had assisted him to the best of our abilities in the second and last; only the other day we were discussing what fresh honour we could devise for him when in a few months' time he was expected home in triumph. If we cannot crown him and his companions with a fresh laurel wreath, at least let us lay our chaplet of mourning upon their glorious graves.

And first as to the men themselves. Their portraits and their features are now familiar to the whole world, but let me try to express here, in a few sentences, what manner of men they were. Captain Scott has shown in the last hours and in the latest words of his life, what his whole life had conclusively proved to his friends. Simple-minded, high-souled, earnest, indomitable, a wonderful organizer, a natural leader of men—his main characteristic was his utter disregard of self. His last thoughts were for his comrades, his last praise for them, his dying wish to impute no human blame, but to accept without a murmur the inscrutable decrees of Providence. Can anything be more beautiful than the calm heroism with which he sat down with death staring him in the eyes, and weighed in the scales the doings of himself and his comrades? The result is that this plain man, who claimed powers neither of speech nor writing, has left a message which will outlive the highest flights of trained eloquence. This explorer, who reached his goal only to find that he had been anticipated by another, and who died in the hour of his maimed achievement, will be remembered longer than many winners of an unchallenged prize.

I fully anticipate that when Scott's diaries and records come home, and the book is published, it will be found that this expedition is unique in the records of Polar Exploration for its scientific completeness and its results. I was permitted by his wife—now, alas! his widow—to see the private diaries which he continued to send home until he disappeared upon his last march, and I find it hard to say whether my impression is more vivid of the hardships and sufferings cheerfully endured, of the patient effort to add to human knowledge, or of the invincible spirit in which the writer faced his task.

So much has been written of Captain Scott that people have hardly grasped the fact that in Dr. Wilson the country has sustained a scarcely inferior loss. A skilful naturalist, an accomplished artist, an expert medical officer, he was Scott's right-hand man and trusted counsellor. A man who between spells of Antarctic exploration (for he had been with Scott on his previous expedition) and professional duty, could contribute to and illustrate a Parliamentary Report on Grouse Disease, must have been no ordinary person. You have merely to read Scott's reports to realize Wilson's ubiquitous energy and unfailing tact.

Then we come to Captain Oates—the Eton boy, the cavalry officer, the South African hero, the English gentleman. Does history contain a finer

picture than this young fellow, only thirty-two years old—exactly the same age as Sir Philip Sydney at Zutphen—walking out of the tent into the shrieking snowstorm to give up his life for his friends? Have the greatest prose writers in the world ever composed a nobler epitaph than the words which the search party cut upon a rude cross in the vicinity of his self-sacrifice?—

"Hereabouts died a very gallant gentleman."

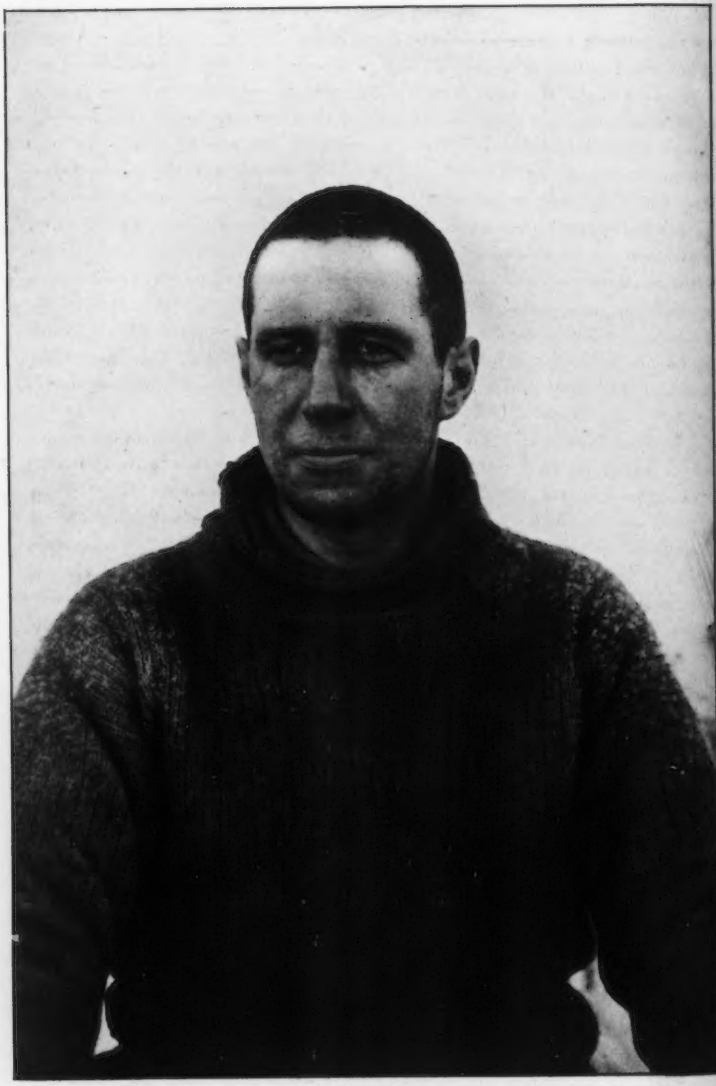
Nor must we forget the commissariat officer, Lieut. Bowers, who came from that splendid little service the Royal Indian Marine, and who must have possessed rare merits to be selected by Captain Scott out of all the eager candidates for the last march to the Pole. And, finally, Petty Officer Evans, the strong man with the open countenance, whom Scott had known on H.M.S. *Vernon*, on whom he relied implicitly, and whose unaccountable breakdown was the first symptom, and possibly the initial cause, of the ultimate disaster.

These were the five men whom we mourn, with whose widows and families we condole, but for whose shining example their country is grateful, and the world the better. May I add the expression of a personal hope that, subject to any strongly avowed wish by those who have an incontestable right to utter it, their bodies may be left where they lie, with the snow as their winding-sheet, the eternal ice as their tomb, and the solemn Antarctic wastes as the grave-yard in which it has pleased God that they should sleep? Scott, in particular, could not have a more fitting resting-place than on that great frozen Barrier, whose secrets he was the first to reveal, and amid the scenes which his life and death have rendered immortal.

And now I turn to certain aspects of the Expedition, upon which much speculation has been indulged in, and about which a few words may not be out of place. First, as to the cause of the disaster. I think we shall do well to accept the balanced judgment of the Commander of the Expedition himself, recorded in circumstances which render deception impossible. Just as Amundsen was favoured by an extraordinary combination of fine weather, physical health, and good luck, so Scott had to battle with the triple foe of climatic conditions, unprecedented and unimagined for their severe and malignant intensity, the breakdown of two of his party, and adverse fortune at every turn.

Up to the Pole all went fairly well, and the fact that the party were only two days later than the anticipated date of arrival, shows that till then nothing serious was amiss. I do not attach any weight to the disappointment alleged to have been caused by the discovery of Amundsen's tent. The whole party knew that he had the start of them, and might, therefore, be the first to arrive, and moreover, they had picked up his dog-tracks before reaching the Pole.

DR. E. A. WILSON.
(*Photo: H. G. Ponting.*)



CAPTAIN L. E. G. OATES.
(Photo: H. G. Ponting.)

The return journey also began under favourable conditions; but it would seem that Evans must soon have broken down, and become a burden to his companions, retarding their advance and making inroads upon their dwindling stock of food. When Oates, too, began to fail, and his intense sufferings were daily witnessed by a party already losing spirit and strength, the downward incline must have been rapid. It is easy to be wise after the event, and to say that the addition of a fifth man to the party of four that was originally intended for the Pole, the postponement of the start for a whole month, because of the collapse of the ponies—but for which postponement Scott and Amundsen might actually have met and shaken hands at the Pole—and above all the decision of Scott to rely upon human haulage in preference to dogs, were contributory or ulterior causes of the disaster. There is probably truth in all of these surmises; but it should be borne in mind that only 11 miles separated the final trio from safety, and that, had they won through, criticism would perhaps have assumed a very different form.

It does, however, I think, emerge from all these circumstances, that while with good luck the British organization, which was extraordinarily thorough and complete, might have stood the strain, the Norwegians' equipment of 120 dogs—Scott had only 30, which were left behind at the Beardmore glacier—and of men not required to pull, and life-trained to the use of *ski*, was a superior mechanism for swift progress on the plateau, and even on the barrier itself, and might—though of this we cannot be certain—have been a more efficient safeguard against unforeseen misfortunes either of accident or climate. The merits of haulage by dogs are indeed self-evident in (*a*) saving of time, (*b*) relief from the fatigues of human traction, (*c*) economy of food supplies, the dogs as they are killed being available as food both for the surviving animals and for men.

It is a mistake, however, to suppose, as has been done in some quarters, that the Englishmen were either indifferent or hostile to the use of *ski*. On the contrary, Captain Scott was a *ski* enthusiast; all the members of his party were expert in their use, and it is clear from a reference to Evans' *ski*-shoe that they employed them in the last march to the Pole. *Ski*, however, are of no advantage on a hard *névé* surface, and can only be used with effect when the snow is soft. The incessant wind that prevailed on the return march, together with the exceedingly low temperature, may have rendered the surface unsuitable for *ski*, and the carrying of the *ski* would in that case be an actual burden.

I pass to the conjectures that have been framed as to other and contributory factors in this tragic tale. As regards the stores of fuel in the depôts, this is a matter which may well be left over until the expedition comes home. It would be a cruel injustice to add unwarrantable suspicion to the burden of sorrow and suffering already laid upon these afflicted men.

Similarly, with regard to the relief parties, is it credible that men who had lived together and endured together through two polar winters, who adored their commander and were inspired by a chivalry scarcely inferior to his own, should have faltered in an attempt in which his life and that of their comrades were at stake? We know that Dr. Atkinson was powerless to leave Lieut. Evans, who was sick with scurvy, but the dog teams set out on the exact date appointed by Captain Scott. Only two men were available for this attempt, Cherry Garrard—himself an enthusiast, who, like Captain Oates, had given £1000 to the cost of the expedition—and the Russian dog-driver Dimitri. After a week's waiting at One Ton Camp they were forced to return by the exhaustion of their food supplies, the condition of the dogs, and the increasing debility of the two Europeans. It must be remembered that the dogs had been almost continually engaged from September in hauling heavy loads from Cape Evans to Discovery Hut—a distance of 15 geographical miles, and to Corner Camp, 30 geographical miles further southwards. They had then accompanied Scott's party as far as the Breadmore glacier, 360 miles from the main base, drawing loads about 20 per cent. in excess of their own weights, had covered the same distance back again, and had been employed at the base camp since. No wonder that these faithful animals broke down, and could not be kept at One Ton camp any longer after their food had given out.

Then as regards the second attempt of Dr. Atkinson and Seaman Keohane, who went from Discovery Hut as far as Corner Camp, we may be sure that this was the supreme effort which it was possible for them at that time to make. The main base at Cape Evans was cut off from them by 15 miles of open water, and there was no means of communication between the two. The main party at Cape Evans therefore knew nothing of what was transpiring elsewhere; they must have thought that Captain Scott and his companions had returned in safety to Discovery Hut. And it would not have been until the sea froze, and communication was re-established, that they had any chance of hearing from Atkinson or Cherry Garrard that anything untoward had happened.

After that ensued the fierce rigour and gloom of the Antarctic winter, in which movement is impossible—a period no doubt rendered insupportable to these brave men by the consciousness that their commander and his comrades had perished. Let us sympathize with them in their anguish rather than wound them with uncharitable and baseless imaginings.

Such are the facts of the case, *i.e.* so far as they can be gathered from the information at present at our disposal. It only remains for me to add one word of congratulation upon the remarkable work performed and the fortitude exhibited by the other parties—whose achievements must not be forgotten in the mourning over the loss of their chief—notably the

LIEUTENANT H. R. BOWERS, R.I.M.
(Photo: H. G. Ponting.)

PETTY OFFICER EDGAR EVANS, R.N.
(*Photo: H. G. Ponting.*)

northern party, under Lieut. Campbell, who spent an entire Antarctic winter in a hole in a snow-drift, under conditions such as few men have experienced and fewer still have survived. All honour to the bravery and the services, not only of the men who died, but of the other men who will soon be home.

One other question alone will I attempt to answer. It is the question everywhere being put in other than purely scientific circles—the eternal and possibly unanswerable query, *Cui bono?* Was the deed worth the price? What has the world gained by the sacrifice? Perhaps the best answer that I can give to this question is that which was furnished in anticipation by Captain Scott himself in a note written just before he left England in July, 1910. He then said :—

"I submit that the effort to reach a spot on the surface of the globe which has hitherto been untrodden by human foot, unseen by human eyes, is in itself laudable; and when the spot has been associated for so long a time with the imaginative ambitions of the civilized world, and when it possesses such a unique geographical position as a pole of the Earth, there is something more than mere sentiment, something more than an appeal to our sporting instinct, in its attainment; it appeals to our national pride and the maintenance of our great traditions, and its quest becomes an outward visible sign that we are still a nation able and willing to undertake difficult enterprises, still capable of standing in the van of the army of progress.

"But though this attainment of a pole of the Earth be in itself a high enterprise worthy of national attention, it must be obvious that there are various ways in which such a project can be undertaken. It is possible to conceive the record of a journey to the Pole which would contain only the number of paces taken by the party, the food eaten, or the clothes worn. The interest of such a record would be entirely marred by our disappointment that so rare an opportunity to add to human knowledge should have been missed.

"It becomes, therefore, a plain duty for the explorer to bring back something more than a bare account of his movements; he must bring us every possible observation of the conditions under which his journey has been made. He must take every advantage of his unique position and opportunities to study natural phenomena, and to add to the edifice of knowledge those stones which can be quarried only in the regions he visits. Such a result cannot be achieved by a single individual, or by a number of individuals trained on similar lines. The occasion calls for special knowledge and special training in many branches. I have entered into these preliminary explanations in order to show the objects I have had in view in organizing the expedition.

"I have arranged for a scientific staff larger than that which has been

carried by any previous expedition, and for a very extensive outfit of scientific instruments and impedimenta. Doubtless there are those who will criticize this provision in view of its published object—that of reaching the South Pole. But I believe that the more intelligent section of the community will heartily approve of the endeavour to achieve the greatest possible scientific harvest which the circumstances permit."

I will not pause to consider what the scientific results of this Expedition will be, or the contributions that may be expected to geology, meteorology, magnetism, hydrography, marine biology, and other branches of knowledge. Time will show their extent and value. Captain Scott, dragging his 35-lbs. weight of fossils with him to his death-tent, did not, at any rate, despise their scientific importance. But surely the question is not whether the world is the better or the wiser because we know something more about the conditions of the frozen world at the Southern pole. It does not matter to us very much that it was once united to the Australasian and South American continents; that it once enjoyed a more temperate climate; or that forests flourished there which have left traces of coal beneath the ice and the snow. But it does matter to us and to the entire world a great deal that men have been found in this, as in earlier and perhaps more virile ages, to run great risks for a great idea, to count life itself as dust in the balance compared with supreme human endeavour, and to meet death without repining even on the threshold of victory and fame.

It is said that the death of such men is their best memorial. True, but I think that it behoves their countrymen to commemorate them also, firstly by providing for their dear ones, and carrying to final execution the objects for which they gave their lives, but also by setting up some visible monument, which will show that they were worthy to take their place alongside of the national heroes who have died and been similarly honoured before them, and that even this breathless generation can pause to remember and would be ashamed to forget.

I will add no more, but on behalf of this Society I conclude by moving —"That the President, Council, and Fellows of the Royal Geographical Society desire to place on record their sense of the inestimable services that have been rendered to the cause of geography and science, and to humanity, by Captain Scott and his brave companions, and to convey to the widows or families of Captain R. F. Scott, Dr. E. A. Wilson, Captain L. E. G. Oates, Lieut. H. R. Bowers, and Petty Officer Edgar Evans, their profound sympathy in the irreparable loss which they have sustained."

ROBERT FALCON SCOTT.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

The career of the Society's great polar explorer has closed in the midst of his discoveries. It was a very noble and glorious termination of a life devoted to duty and to his country's service.

As the present writer had known Captain Scott intimately for a quarter of a century, and was responsible for his first Antarctic appointment, he feels anxious to bear his testimony to the beauty of an exceptionally noble character.

I well remember my first acquaintance with the young midshipman; it was at St. Kitts, in the West Indies. The lieutenants of the training squadron had designed a cutter race to test the qualities of the younger officers. It was not to be a mere race from point to point. The cutters were to be fast, with oars in and masts down. They were to get under weigh, make sail, race round a buoy; then down masts, pull round a second buoy, return to the first place and make all secure again. Scott won the race. I was already agitating for the resumption of Antarctic research, and I saw in the young midshipman the makings of a good polar officer. After the training squadron time was over, I knew him as a very active torpedo lieutenant on board the *Empress of India* at Vigo and Gibraltar. When at last, after years of hard work, the princely liberality of Colonel Ll. W. Longstaff made an Antarctic expedition possible, and the keel of the *Discovery* was laid down, I applied to Sir Richard Egerton, one of the most distinguished of our surviving Arctic officers, as the best judge then on active service, to tell me who, in his judgment, was the best all-round man to command the expedition. He named Scott, the winner of the cutter race, who also came to me and volunteered. After much harassing opposition, Scott was appointed, with the warm approval of Lord Goschen and Lord Walter Kerr. The *Discovery* was not finished. He at once took charge. He made himself very thoroughly acquainted with everything that had been done before in the polar regions down to the minutest detail. He superintended the completion of the ship, and her special fittings for polar scientific work. Questions of clothing, provisions, equipment were carefully studied. It was clear that a master mind was at work. Scott had the rare gift of forming great conceptions while attending to the most minute details. He proved to be a born leader of men, and all his people adored him and felt the utmost confidence in him. For such a man all vied with each other to do their best. Scott was a keen observer; nothing escaped him. He was unostentatiously religious, as all our greatest polar men have been—Parry, Franklin, McClintock. He always, at divine service, read the Lessons on board the ships he commanded. He was also

very keen in providing instruction, and above all amusement, for his people.

Scott was the creator and first organizer of Antarctic sledge travelling, his plans being based partly on a minute study of all previous Arctic experiences, but mainly on his own very careful examination of what had since been discovered, and on his own conception of the differences which exist, in some respects, between the two regions.

The results of Scott's first expedition were the richest and most important that any expedition has ever achieved. He examined and surveyed the great ice barrier with numerous soundings. He discovered King Edward land. He discovered Ross island. He examined and discovered the character of the ice surface on the barrier. He discovered the great Victorian range of mountains, and that glaciers descended to the barrier at intervals of about 100 yards. He discovered the great ice-cap, and he alone has penetrated far into it for 166 miles at right angles with the line of mountains. He did this with only two companions, one of the most remarkable polar journeys on record. By his observations, Captain Chetwynd fixed the position of the south magnetic pole. His very able and indefatigable observers enabled him to bring back precious results in all branches of science, filling twelve folio volumes.

The mere enumeration of his results are sufficient to establish the unequalled greatness of the achievement. Yet Scott felt it was incomplete. The south pole had to be reached, and he knew, from the trend of the land at his furthest southern point, that the pole was on his ice-cap. It was also an important desideratum to ascertain the geological period of his mountains by the discovery of fossils.

Captain Scott's promotion to post rank made it incumbent that he should first serve his sea time. He commanded the *Victorious*, bearing the flag of Sir Richard Egerton, at Gibraltar and in the Mediterranean, and the *Bulwark* independently, and finally he was assistant to the First Sea Lord at the Admiralty. At that time he married very happily, finding in Mrs. Scott a very perfect helpmate, entering fully into his plans, attending to the interests of the expedition with business-like ability and aptitude, and looking after the welfare of all connected with it.

The time arrived for Captain Scott to command a second expedition. Funds were raised in 1910–1911; the *Terra Nova*, a suitable ship, was bought and equipped, and an exceptionally able and efficient scientific staff was secured. Dr. Wilson, the chief of that staff, had served in the *Discovery*, and Captain Scott, while impressed by his ability, had formed an affectionate friendship for one whose amiable qualities and unswerving loyalty were fully worthy of it.

In the very first season the geologists discovered fossils which will establish the age of the Victorian mountains. The winter was passed with

much satisfaction, the time being taken up with lectures and discussions, and with preparations for the great achievement and observations.

An officer of Captain Scott's great experience and ability could make such arrangements as would ensure success under ordinary circumstances. His plan for three sledge-parties, starting from the foot of the glacier, to advance so as to place one sledge, fully provisioned, within striking distance of the Pole, were perfect, as well as his system of depôts. It is not possible to travel during a gale of wind with the thermometer at -40°, and detention in the tent, of greater or less duration, was inevitable. By allowing margins, such detentions were also provided for. This was all that human foresight, guided by the skill and experience of a great leader, could do. The five heroes arrived at the South Pole exactly as had been arranged.

With men dragging their own laden sledges, it was by far the finest sledge journey that has been achieved in either of the polar regions. But, alas! there is one thing that may cause danger, and even a catastrophe, and which no human foresight can prevent. Here lies the inevitable risk and danger, and there must be such risk. It is not the fearful gales. It is the breaking down of a comrade, either through accident or an illness, at too great a distance from help. Poor Evans broke down, thought to be their strongest man. He died a natural death, but the delays caused by his inability to march, had fatally thrown out the calculations. Then Captain Oates, who had done such splendid work throughout, succumbed and went through terrible sufferings. The other three could easily have saved themselves if they had bade farewell to their disabled comrades. This was impossible with such men, and Captain Oates well knew that they would rather perish with him than leave him. So he resolved upon a heroic act which should be remembered wherever brave deeds are recorded. He left the tent to perish, so that his friends might be saved.

Alas! it was too late. Scott, Wilson, and young Bowers pushed on for several marches, and were even within 11 miles of the depôt. But a furious gale forced them to remain in the shelter of the tent, and they perished, being without food and fuel, and exhausted.

Scott's dying message to his countrymen is one of the finest pieces of writing in our language; it stands side by side with the last words of Sir Humphrey Gilbert. Both were men of Devon; but Scott reminds me most of my old messmate Mecham, the greatest of Arctic, as Scott was the greatest of Antarctic, sledge-travellers. Scott's was indeed a very beautiful character. He never thought of himself; his very last thought was for others. He was anxious lest there should not be sufficient funds to pay the wages of his people. One of his last acts was to give up his pay, and every sum that might accrue to him from newspapers, lectures,

or any other sources, to the expedition. His wife has already paid in a large sum due to him, for the good of the fund.

Our lost friend was a true hero. He was firm and just, even severe, and to some he cared for most, if duty required it; but always kind and considerate. His noble and chivalrous nature scorned to take offence or to harbour a grievance. He disliked the evil deed, not the doer. He may have had enemies—who has not?—but he was no man's enemy. Beloved and respected by all who knew him, Robert Scott died as he had lived, a faithful and zealous servant of his King and country, a martyr in the cause of science.

MESSAGES OF CONDOLENCE.

Innumerable messages of condolence and sympathy have been received by the Society. The following is from the King to the President:—

"I am deeply grieved to hear the very bad news which you give me of the loss of Captain Scott and four of his party just when we were hoping shortly to welcome them home on return from their great and arduous undertaking. I heartily sympathize with the Royal Geographical Society in the loss to science and discovery through the death of these gallant explorers.

"Please send me any further particulars.

"(Signed) GEORGE R. AND I."

From Queen Alexandra the following message has been received:—

"DEAR LORD CURZON,—Queen Alexandra desires me to tell you how deeply grieved she is to hear this terrible news of the death of Captain Scott and his party in the Antarctic. Her Majesty feels that the death of these brave explorers and their intrepid leader is an incalculable loss not only to the nation, but to the great Society of which you are the president.

"It may be some slight consolation to know that their purpose has been achieved, and Her Majesty is certain their splendid and successful undertaking in the cause of science and discovery will for ever be gratefully remembered by the people of this country.

"Her Majesty has read the pathetic and touching message which Captain Scott left behind him, and is confident that it will not pass unheeded. I am to assure you of Queen Alexandra's intense feelings of sorrow at this disaster, and to say how full her heart is of sympathy for Mrs. Scott and the relatives of those who have perished in the performance of their duties. Believe me, yours sincerely,

"(Signed) HENRY STREATFIELD."

King Haakon of Norway telegraphed as follows: "Accept my heartfelt sympathy in the dreadful loss of poor Captain Scott and his brave followers.—HAAKON R."

King Christian of Denmark as follows: "I express my sympathy on account of the sad news of Captain Scott's expedition.—CHRISTIAN R."

Messages of condolence have been received from the following: His Majesty the King; Her Majesty Queen Alexandra; King Haakon of Norway; King Christian of Denmark; H.M. Minister, Christiania, on the feeling in Norway; Governor-General of the Commonwealth of Australia; Governor of Western Australia; Italian Minister for Foreign Affairs; Bolivian Government and Consul-General; Citizens of Baltimore; Royal Scottish Geographical Society; Manchester Geographical Society; Liverpool Geographical Society; Tyneside Geographical Society; Queensland Royal Geographical Society; Adelaide Royal Geographical Society; Paris Geographical Society; Berlin Geographical Society; Italian Geographical Society; Vienna Geographical Society; Madrid Geographical Society: Neuchâtel Geographical Society; Lima Geographical Society; Hungarian Geographical Society; Swedish Geographical Society; Norwegian Geographical Society; Belgian Geographical Society; Antwerp Geographical Society; Baron Hulot, Secretary, Paris Geographical Society; American Geographical Society; Imperial Russian Geographical Society; Royal Danish Geographical Society; Lisbon Geographical Society; Geneva Geographical Society; Geographical Society of Philadelphia; Geographical Society Le Mans; British Association; Royal Meteorological Society; Royal Anthropological Institute; Royal Philosophical Society of Glasgow; Manchester Geological and Mining Society; Paisley Philosophical Institution; Plymouth Mineralogical Society; Royal Society, New South Wales; Australasian Association for the Advancement of Science; Linnean Society, New South Wales; Peary Arctic Club; German Antarctic Expedition; Japan Antarctic Expedition; University of Norway; Society of Naturalists, Odessa; Société Zoologique de la France; Société Republicaine des Conferences Populaires; Frankfort Geographical and Statistical Society; Westminster City Council; Walthamstow Urban District Council; Ormesby Urban District Council; County Borough Council, Southampton; Edmonton Urban District Council; Navy League; British Shipmasters' and Officers' Protection Society; Royal National Lifeboat Institution; The Sailors' Home; Norwegian Chamber of Commerce; Committee of Paris Societies; Royal Yacht Club of Belgium; Johannesberg Stock Exchange; Junior Imperial and Constitutional League (Lincoln Branch); Troedyrhiw Chamber of Commerce; N.U.T. Northumberland County Association, and Tynemouth Association; Dr. Fridtjof Nansen;

Dr. Sven Hedin; Dr. J. Charcot; Maj.-Gen. A. W. Greely; Captain de Gerlache; Lieut. Filchner; M. Charles Lallemand; Lieut. Royds; Lieut. A. B. Armitage; Senhor Augusto Ribeiro; Dr. Filippo de Filippi; Colonel Borup; Dr. Otto Nordenskjöld; Captain Gunnar Isachsen; Carsten Borchgrevink; Dr. Carl Lumholtz; Dr. Erich von Drygalski; Colonel Ll. W. Longstaff; J. M. Farman; R. Harding; W. M. Davis; Captain W. Colbeck; Dr. Francisco Moreno; M. Henri Cordier; M. Lecointe; Commander Carl Ryder; Dr. and Frau George Wegener; Prof. Dr. G. Merzbacher; Henry M. Ami; R. E. Godfrey; M. Charles Rabot; Dr. W. H. Neale; T. V. Hodgson; Captain Irizar; Dr. A. G. Nathorst; Dr. E. Gourdon; M. Gabriel Bonvalot; Captain Alfred Bertrand; Twickenham Urban District Council; Avon Club; Young Men's Guild, St. Peter's Sunday School, Manchester; Messrs. Peter Dawson, Ltd.; Walthamstow Property Owners' Association; two hundred children Liverpool Elementary Schools; St. Paul's Troop (Bournemouth) B.P. Scouts; Women's Patriotic Club, Sydney; R.A.O.B. Lodges, 5; "Sons of England" of Stockport, Winnipeg, Ottawa, Transvaal.

HONOUR FOR MRS. R. F. SCOTT.

THE King has been pleased to grant to Mrs. Kathleen Scott the same rank, style, and precedence as if her husband, Captain Robert Falcon Scott, R.N., C.V.O., had been nominated Knight Commander of the Bath, as he would have been had he survived.

CAPTAIN SCOTT'S ANTARCTIC EXPEDITION: SECOND YEAR'S RESULTS.

IN the following paragraphs a condensed summary is given of the facts so far made public in the despatches sent home by Commander Evans through the *Central News*. A few points relative to the earlier course of the expedition may be first recalled to mind. The *Terra Nova* reached McMurdo sound on January 20, 1911, headquarters being established at Cape Evans. Captain Scott, Lieut. Evans, and the Southern party proceeded to establish depôts, fixing an advanced base 7 miles east-south-east of Hut Point. Other depôts were established to the southward, including one at Corner Camp, 27 miles east-south-east of the Hut Point base, and another at "One Ton Camp," in 79° 30′ S., 169° 23′ E. It having been found impossible to land a party, as proposed, on King Edward VII. land,

a "Northern party" was landed at Cape Adare on February 18, from the *Terra Nova*, during her return voyage to New Zealand. Winter work was carried out at both Cape Evans and Cape Adare, a specially noteworthy undertaking being the mid-winter expedition of Dr. Wilson, Lieut. Bowers, and Mr. Garrard to Cape Crozier, to study the breeding conditions of penguins.

The southern party was delayed in starting by adverse weather, but finally set out on November 2, 1911, further stores having been taken forward previously by the supporting parties. The main party reached lat. 83° 24′ S. on December 4, and Beardmore glacier on the 10th. Depôts were left at every degree of latitude, and up to this point the transport had been accomplished by ponies and dogs; from this time, however, the party relied on its own powers to haul the sledges. Lat. 87° 36′ S. was reached on January 4, 1912, and here the last supporting party, consisting of Lieut. Evans, Mr. Lashley, and Petty-Officer Crean, turned back, leaving Captain Scott, Dr. Wilson, Captain Oates, Lieut. Bowers, and Petty-Officer Evans to press forward. The party continued its march at an average of 12 miles per day, and reached the Pole on January 17, finding there the tent and records left by Amundsen during the previous month. From 88° onwards his trail had been picked up and followed. The first day at the Pole was cloudy, but on the 18th sights of the sun were taken with a 4-inch theodolite, the results differing by only half a mile from Amundsen's, obtained by sextant. As the latitude worked out as 89° 59½′, the party marched on another half-mile and there planted the Union Jack. The temperature was about 20° below zero (Fahr.), and the surface was soft, with no crust. Photographs were taken, the films being eventually recovered and developed. They include two of Amundsen's tent as found.

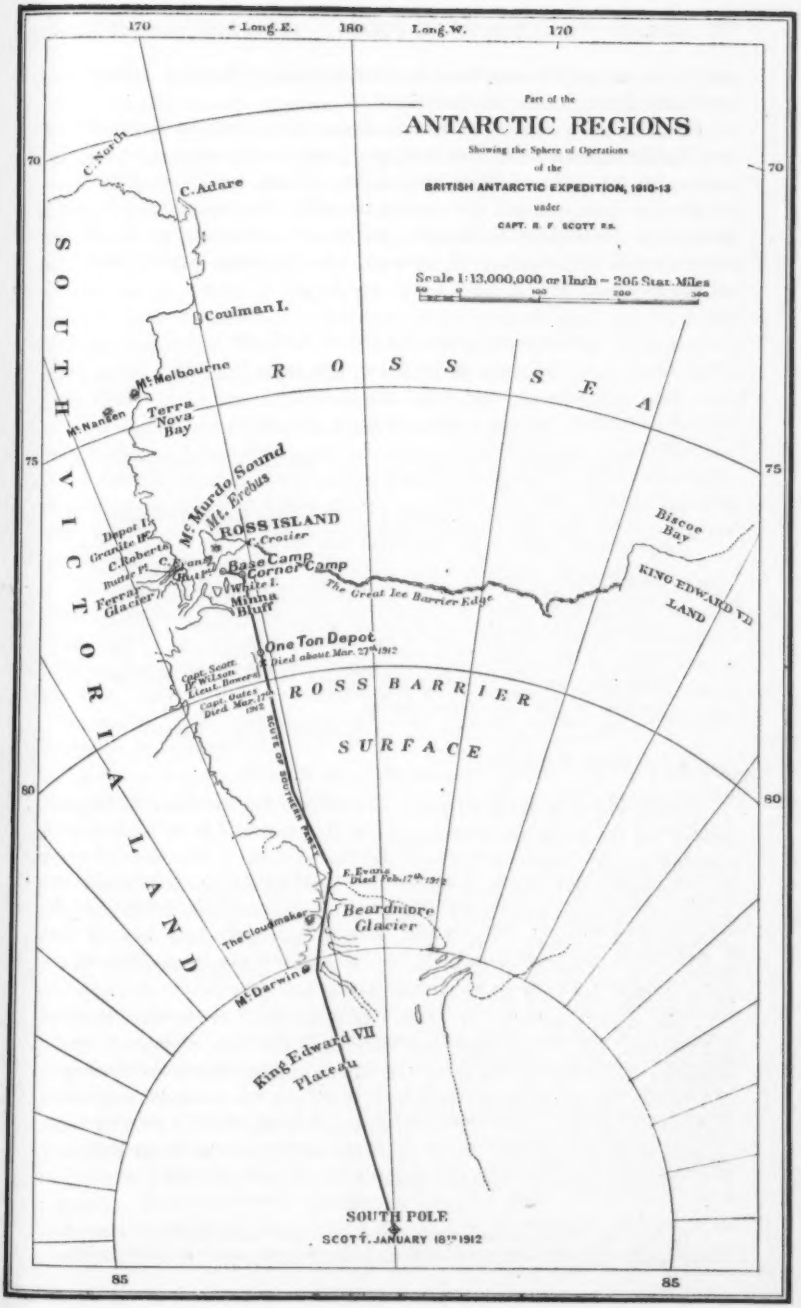
Taking with them Amundsen's records, the party began the return journey, which was at first marked by good marches (one of 18 miles) and medium weather, with temperatures between 20 and 30 degrees below zero. Both depôts on the plateau, in 89° and 85° 7′ S., were secured. Before descending the Beardmore glacier, Dr. Wilson and Lieut. Bowers visited the large nunatak named Buckley island, and made a good collection of fossils from the sandstone which represents the latest sedimentary deposit yet found in Victoria Land, as well as specimens of coal.* During the descent of the glacier much older fossils, occurring in limestone, were obtained near the depôt beneath the Cloudmaker peak. In all thirty-five pounds' weight of specimens were taken forward right up to the last camp, and have all been recovered. Henceforward deep snow-surfaces were encountered, which, with abnormally bad weather, severely hampered the march. Petty Officer Evans, whose health had caused much anxiety from the time of reaching the Pole, fell among rough ice, severely injuring his

* Coal had been found on the glacier in 1908 by Mr. Wild, of the Shackleton Expedition.

head. His condition seriously delayed the party, and the surplus food gradually diminished. On February 17, having fallen behind owing to an accident to his foot-gear, he was found by his companions in a state of collapse, and died within two hours of reaching camp. This delay had serious consequences, for, owing to the lateness of the season and consequent fall of temperature, the surface became like sand, the ice-crystals failing to melt under the friction of the sledge. Progress became increasingly slow, and it was impossible to maintain the average of 9 miles a day necessary to admit of a full ration of food and fuel between the depôts. Captain Oates had by this time begun to fail, and was a continual tax on the energies of the party, whose case was rendered worse by persistent winds and frequent blizzards. At length, feeling himself but a drag on his companions, Captain Oates took the heroic resolution of setting them free by walking out alone into the blizzard, and was never seen again. He had borne intense suffering for weeks without complaint, and Captain Scott wrote of him: "He was a brave soul. He slept through the night hoping not to wake, but he awoke in the morning. It was blowing a blizzard. Oates said, 'I am just going outside, and I may be some time.' He went out into the blizzard, and we have not seen him since." The rest struggled on, in abnormally bad weather, to a point in 79° 40′ S., 169° 23′ E., only 11 miles south of "One Ton Depôt." The blizzard continuing, and both food and fuel being quite exhausted, in their weakened state they could make no further advance, but calmly awaited death in their tent, where their bodies were eventually found. The last entry in Captain Scott's diary was on March 24, while the 25th was spent by him in writing the touching message to the public printed above. His death is supposed to have occurred about March 27.

Meanwhile, before the sailing of the *Terra Nova* for New Zealand, a relief party, consisting of Mr. Cherry Garrard and the dog-driver Demetri, had been sent south by Surgeon Atkinson, in charge of the Western party at Hut point, he himself remaining in medical charge of Commander Evans, who, as will be remembered, had nearly died of scurvy. It reached One Ton depôt on March 3, and remained till March 10, when it was forced to return owing to the shortness of the dogs' food supply and their poor condition, which rendered them unfit for further work on the return to Hut point. The two men were also quite incapacitated. The ship having now departed, Surgeon Atkinson and Seaman Keohane, the only remaining members of the party, made a second gallant attempt to convey help to their leader, but were forced by the unusually severe weather to turn back after depositing a week's supplies at Corner camp.

During the height of winter further measures were impossible, but in October two search parties were organized by Dr. Atkinson, and left Cape Evans on the 30th. The first consisted of Dr. Atkinson, Mr. Garrard, and Demitri, with teams of dogs; while the second, consisting of Mr. Wright, Mr. Nelson, Mr. Gran, Mr. Lashley, Seamen Crean, Williamson,


170
Long.E.
180
Long.W.
170
Part of the
ANTARCTIC REGIONS
Showing the Sphere of Operations
of the
BRITISH ANTARCTIC EXPEDITION, 1910-13
under
CAPT. R. F. SCOTT R.N.
Scale 1:13,000,000 or 1 Inch = 206 Stat. Miles
70
C. Norths
C. Adare
Coulman I.
SOUTH VICTORIA LAND
ROSS SEA
Mt. Melbourne
Mt. Nansen
Terra Nova Bay
75
McMurdo Sound
Mt. Erebus
ROSS ISLAND
Depot D
Granite H.
C. Roberts
Butter P.
C. Evans
Hut
Crozier
Base Camp
Corner Camp
White I.
Minna Bluff
Ferrar Glacier
The Great Ice Barrier Edge
Biscoe Bay
KING EDWARD VII LAND
One Ton Depot
Died about Mar. 22nd 1912
Capt. Scott
Dr Wilson
Lieut. Bowers
Capt. Oates
Died Mar. 17th 1912
ROSS BARRIER SURFACE
80
ROUTE OF SOUTHERN PARTY
E. Evans
Died Feb. 17th 1912
Beardmore Glacier
The Cloudmaker
Mt. Darwin
King Edward VII Plateau
SOUTH POLE
SCOTT. JANUARY 18TH 1912
85

and Keohane, and Steward Hooper, was furnished with mules. The parties were provisioned for three months.

One Ton camp was found with its stores intact; and on November 12 Mr. Wright's party found the Southern party's tent, sledges, and equipment, with the bodies of Captain Scott, Dr. Wilson, and Lieut. Bowers.

Dr. Atkinson gathered the records, including the documents left at the South Pole by Captain Amundsen, and erected a cairn and cross over the tent in which the bodies were buried. The following record, signed by all the members of the search party, was left:—

> This cross and cairn erected over the remains of
>
> CAPTAIN R. F. SCOTT, C.V.O., R.N.,
> DR. E. A. WILSON, and
> LIEUT. H. R. BOWERS, R.I.M.,
>
> as a slight token to perpetuate their gallant and successful attempt to reach the goal.
>
> This they did on January 17, 1912, after the Norwegians had already done so on December 14, 1911.
>
> Also to commemorate their two gallant comrades, CAPTAIN L. E. G. OATES, of the Inniskilling Dragoons, who walked to his death in a blizzard willingly, about 20 miles south of this place, to try and save his comrades beset by hardship; also PETTY OFFICER EDGAR EVANS, who died at the foot of the Beardmore glacier.
>
> "The Lord gave and the Lord taketh away. Blessed be the name of the Lord."

Search was then made 20 miles southwards for the body of Captain Oates; but the party was unsuccessful in this, and had to be content with erecting another cairn and record in the vicinity. The search party then turned north again towards the base, bringing with them the whole of the Southern party's records and collections, including the geological specimens. Dr. Atkinson and his colleagues reached Hut point on November 25, to find that the northern party, concerning which much anxiety had been felt, had now arrived safely.*

This party, consisting of Lieut. Campbell, Dr. Levick, Mr. Priestley, and Seamen Abbot, Browning, and Dickinson, had been picked up by the returning *Terra Nova*, after their first winter at Cape Adare, on January 4, and landed again in Terra Nova bay, equipped for a month's summer exploration, on January 8. The ship, however, was unable to pick them up after visiting McMurdo sound, and after waiting for her from February 17 to March 1, Lieut. Campbell decided to winter. An igloo was cut in

* In April Dr. Atkinson and three companions had made a gallant attempt to relieve Lieut. Campbell, but had been turned back by open water at Butter point.

a snowdrift, insulated with seaweed, and here the party spent the winter, living mainly on seal meat and blubber, helped out by the remnants of their summer provisions, but with never a sufficiency of food to allay the pangs of hunger. They kept a meteorological record, which shows constant winds of gale strength; but were unable to record temperatures owing to the breaking of their thermometer. They suffered a good deal from frost-bites, while the hard living caused an outbreak of enteritis, and so reduced their strength that they could not start to return before September 30. The journey was a trying one owing to blizzards, the difficult crossing of glacier tongues, and the critical condition of Petty-Officer Browning. They were fortunate enough, however, to discover a food depôt at Cape Roberts, which somewhat improved their food-supply, and with it their health. At Depôt island they succeeded in recovering the geological specimens left by Prof. David during Lieut. Shackleton's expedition, and the whole party arrived at Cape Evans on November 7.

Scientific work had been maintained at the base throughout the winter, including an ascent of Mount Erebus by a party consisting of Mr. Priestley, Mr. Debenham, Mr. Gran, Petty-Officer Abbot, Seaman Dickinson, and Steward Hooper.

When the *Terra Nova* returned on January 18, the collections of geological specimens at Cape Royds, Granite harbour, and Terra Nova bay were picked up, the stores taken on board, and food depôts left at Cape Evans, Hut point, and Terra Nova bay. The expedition's last tribute to its late leader and his comrades was the erection of a large cross on Observation hill, looking towards the Barrier surface on which the southern party perished.

After a voyage through seas abnormally crowded by ice, the ship reached New Zealand on February 10, 1913, whence the news was cabled home.

The details of scientific work accomplished, supplied by Commander Evans, show that the harvest in this direction has been decidedly valuable. The geological work of the Southern, Western, and Northern parties will be of importance as supplying evidence relative to a former connection of Australasia with South America through the Antarctic continent. The collections secured by the southern party under the most adverse conditions were made with great judgment, and supply proof that temperate conditions prevailed in the Antarctic at two distinct periods in the past. The western party, under Mr. Griffith Taylor, made two journeys to the mainland of Victoria Land for scientific purposes, carrying out a geological and topographical survey from Mount Discovery to Granite harbour, and collecting material for a thorough description of Antarctic physiography. Measurements of glacier motion were made, this being found to amount to 80 feet in one month in the case of Mackay glacier. Coal, probably of the same age as that of the Beardmore glacier, was found at

Granite harbour in the Beacon sandstone formation, but in an inaccessible situation. Associated with it were the fossil impressions of stems and charred wood, as well as what appeared to be the plates of a fresh-water crustacean. Mr. Priestley, geologist of the northern party, secured valuable collections during the two seasons' work. Large stems of fossil wood were found during a journey along the glaciers between Mount Nansen and Mount Melbourne, and rock specimens were also brought away. A large piedmont glacier, formed by the union of several smaller glaciers, was surveyed. During the ascent of Mount Erebus last December, a different route to that of Prof. David was followed, and the old craters were visited. A temperature of $-30°$ Fahr. was registered at the summit. Mr. Gran, who ascended the final slope after the others had left, was caught and partially suffocated by the fumes of a mild eruption.

Mr. C. S. Wright, the chemist of the expedition, made a complete series of investigations on the physical conditions of the ice, and also carried out the meteorological, magnetic, and gravity observations. The general hydrographical work was carried out by Mr. E. W. Nelson, and the preparation of skins from seals and penguins by Mr. Cherry Garrard. New lines of soundings were taken, and a shoal of 150 fathoms' depth was found in the middle of the Ross sea. Lastly, extensive marine biological collections were made by Mr. Lillie.

THE AUSTRALIAN ANTARCTIC EXPEDITION: LOSS OF TWO LIVES.

Close on the heels of the tragedy of the British Antarctic Expedition comes the news of misfortune to the Australian Expedition under Dr. Mawson, involving the loss of two members of his staff. On February 25 a wireless message from the leader was received at Melbourne *viâ* Macquarie island to the following effect:—

"Lieut. Ninnis, an Englishman, and Dr. Merz, a Swiss, are dead. The other members of the expedition are well. The sledging season has been successful, opening up a large area of new land both east and west of Commonwealth bay, and obtaining important data at a number of stations in close proximity to the Magnetic Pole. Probably six members of the staff and myself will be unavoidably detained another year."

This message was supplemented the same day by one addressed to Inspector-General Ninnis, father of one of the dead explorers, which said, "Deeply regret to advise you by wireless Lieut. Ninnis killed instantly January 14 by falling into crevasse while sledging." The manner in which Dr. Merz lost his life has not yet been announced, and fuller news must be awaited before any clear idea of the general course of the expedition can

be gained, though a few details received from time to time at the wireless station at Macquarie island have now been made public.

Dr. Mawson's plans were so fully dealt with in the *Journal* before his departure (see especially vol. 37, p. 609; 38, p. 320) that it is unnecessary to enlarge upon them here. The main events of the expedition have also been recorded from time to time, but it may be recalled that after getting together an unusually efficient staff and completing his preparations both in this country and Australia, Dr. Mawson sailed from Hobart in the *Aurora* on December 2, 1911, the ship being under the command of Captain J. K. Davis, who had previously commanded the *Nimrod* during the latter part of Sir Ernest Shackleton's expedition. A wireless and scientific station was established on Macquarie island, and, after some delays from ice and bad weather, the Antarctic continent was safely reached, and a main base established at Commonwealth bay, near the western extremity of Adélie Land. Dr. Mawson and the greater part of his staff stayed here, while the *Aurora* proceeded west and landed Mr. Wild * and a smaller party in about 95° E., not far from the winter quarters of the German expedition in the *Gauss*. The ship then returned north, taking soundings *en route*, and afterwards carrying out a winter and a spring cruise for further oceanographical work. A report on the voyage out appeared in the *Journal*, vol. 39, p. 482, and Captain Davis's chart in vol. 40, p. 448.

From letters sent home by Lieut. Ninnis and Mr. Wild in the *Aurora* on her return last year, extracts of which have now been published, one or two additional facts may be gleaned. Lieut. Ninnis, *e.g.*, speaks of the discovery of new land east of Adélie Land † on the voyage out, while Mr. Wild gives some description of the neighbourhood of the winter quarters. He says, "It is a terrible country around here. The ice-cap rises very rapidly to about 2000 feet (we cannot see beyond that). There appears to be a fairly clear track up it from the winter quarters, about a quarter of a mile wide—even that is not entirely free from crevasses—and on either side it is fearfully broken up, like the Beardmore glacier after leaving the blue ice." After describing the difficult task of hauling the stores up the 100-foot face of the glacier, he says, "This glacier should eclipse the Beardmore by at least 50 miles in length and 30 in width."

The messages received at Macquarie island from Adélie Land by wireless appear to have been, with few exceptions, very fragmentary, and the explorers were unable to pick up any messages in return. This was no doubt due to the comparatively low power of the installation taken out, and possibly, in part, to the effect of the continuous daylight. During September terrific winds were reported to have prevented sledging so far, and constant gales and blizzards seem to have continued for some time

* Mr. Wild had taken part both in Captain Scott's first expedition and in Sir E. Shackleton's, being one of the companions of the latter on his march to his farthest south.

† It does not seem, however, to be indicated in Captain Davis's chart.

longer. There was drift snow to a depth of 30 feet all round, the dogs had to be sheltered in the hut, and two of the party suffered from frost-bite. The work of heightening the wireless mast under such conditions was most difficult and trying. On February 16 of this year a message was received reporting that Dr. Mawson and his party were on board the *Aurora*, on the way to pick up Mr. Wild. If this was correct, it would seem that Dr. Mawson landed subsequently, and was unable to reach the ship again before the latter was forced to leave. It seems uncertain whether or not the *Aurora* was successful in picking up Mr. Wild's party.

Lieut. B. E. S. Ninnis, of the Royal Fusiliers, was the son of Inspector-General Ninnis, himself a polar explorer of some experience, having taken part in the Nares Arctic Expedition of 1875–76. Born on June 22, 1887, Lieut. Ninnis had not yet completed his twenty-sixth year. He was educated like Sir E. Shackleton at Dulwich College, afterwards passing on to Sandhurst, and entering the Royal Fusiliers in 1908. From boyhood he had been deeply stirred by the tales of Polar adventure heard from his father, and had been fired with the ambition of becoming one day an explorer himself. While stationed at Mauritius in 1908 he had applied for leave to join Captain Scott's expedition, but, all the vacancies being filled up, he subsequently accepted Dr. Mawson's offer of a place on his staff, made in consideration of his father's former connection with Western Australia. In preparation for the survey work with which he was to be entrusted, he went through a course of instruction at the Society under Mr. Reeves, and showed himself most capable and painstaking. Physically, he stood 6 feet 4 inches in his socks, and was broad in proportion. He was well known in the army as a crack polo player.

Dr. Merz was a Swiss biologist of repute, and also an excellent mountaineer and ski-runner. Before sailing, he went through a course of study at the Oceanographical Institute of the Prince of Monaco, who had generously provided the oceanographical equipment of the expedition.

NOTES ON MOROCCAN GEOGRAPHY.*

By ALAN G. OGILVIE.

The accompanying diagrams and photographs may be found helpful in understanding the geography of Morocco.

Two of the later stages in the geological history of North-west Africa

* A lecture delivered on January 27 at the evening meeting of the Society was in some sense supplementary to the paper read at the afternoon meeting of April 18, 1912, and published in the *Geographical Journal*, June, 1912. In the lecture the dependence of the existing landforms upon the geological history and structure was shown. The climate was described briefly and the main distribution of vegetation types as dependent on climate, relief and soil was indicated. The life of the inhabitants of certain typical districts was described, in so far as it is governed by

are illustrated in Figs. 1 and 3. Fig. 1 shows the distribution of land and sea when, prior to the opening of the Strait of Gibraltar, the connection between the Atlantic and Mediterranean was by a strait south

FIG. 1.—MOROCCO AFTER ELEVATION OF THE MOUNTAIN CHAINS.

of the Riff. The ancient blocks of the earth's crust are seen forming plateaus on the east and west with the freshly folded mountains between and round about them. The great volcanic cone of Jebel Sironia, which

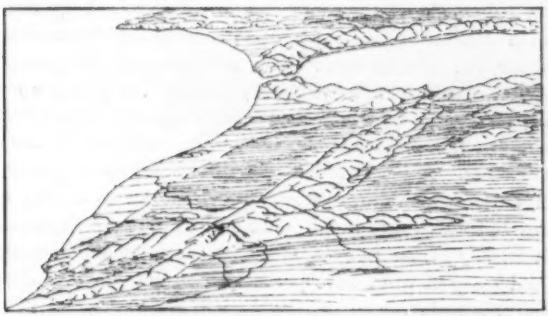


FIG. 3.—MOROCCO AFTER THE OPENING OF THE STRAIT OF GIBRALTAR.

probably rose over all other peaks, is seen in the foreground. Though much lowered by denudation, this is still a mass of some 10,000 feet: see Fig. 2. Fig. 3 shows Morocco after the last great upheaval, which laid bare the coastal plain on the west and dried up the South Riffian strait.

geographical environment. These districts were respectively on the coastal plain, in a valley on the Meseta, at the foot of the Atlas on their western side, and in an oasis of the Saharan border. Finally, the chief effects of the Franco-Spanish treaty of November, 1912, were pointed out. Refer to the series of four maps of Morocco in the *Geographical Journal*, June, 1912.

The Strait of Gibraltar has now been opened, and Morocco is seen to have virtually its present outline.

In Fig. 4* a typical area in the Meseta, or western plateau of Morocco, is shown. The flat-bedded covering of limestones, clays and sandstones gives rise to the predominating landforms of the plateaus; flat-topped and steep-sided hills, and narrow, canyon-like valleys. In strong contrast to these are the rounded hills which appear where the more resistant portions of the old peneplain emerge. So well

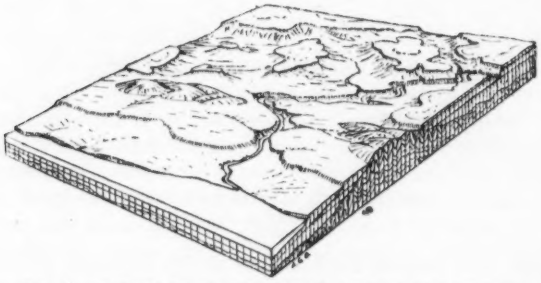


FIG. 4.—LANDFORMS OF THE MESETA BORDER AND COASTAL PLAIN.

marked are these landforms that they are recognized by the natives who have a distinctive name for each, *sokhrat* for the rounded hills, and *gour* for the tabular ones. The remnants of the peneplain are composed of rocks impervious to water, whereas the younger horizontal beds of the plateau are largely porous. Thus from the older round-topped hills what water falls is shed freely, and springs and runnels are common round their bases. Amongst the tabular hills water scarcely ever appears except in those deep valleys which are cut down to a clay or other impervious bed which throws the water out as springs. In most of these valleys it is only in the rainy season that there are continuous flowing streams, and many of them have probably been cut when the climate was wetter than it is to-day.

The western edge of the plateau is marked by a continuous slope down to the coastal plain. It is the remains of an old sea-cliff formed when the sea still covered the plain.

The coastal plain itself is nearly smooth and slopes gently westward. It ends abruptly in a line of high cliffs overlooking the Atlantic, showing that marine erosion has made some progress since the last upheaval of the land.

Fig. 5 is a photograph of one of the deep, narrow valleys of the Meseta.

* These diagrams must not be taken as accurate in detail, or as representing any specific district. They are intended to illustrate with some exaggeration the most striking features of the landforms.

FIG. 2.—JEBEL SIROUA FROM THE NORTH. PASS OF OUGDOUR.
(*Photo: Louis Gentil.*)

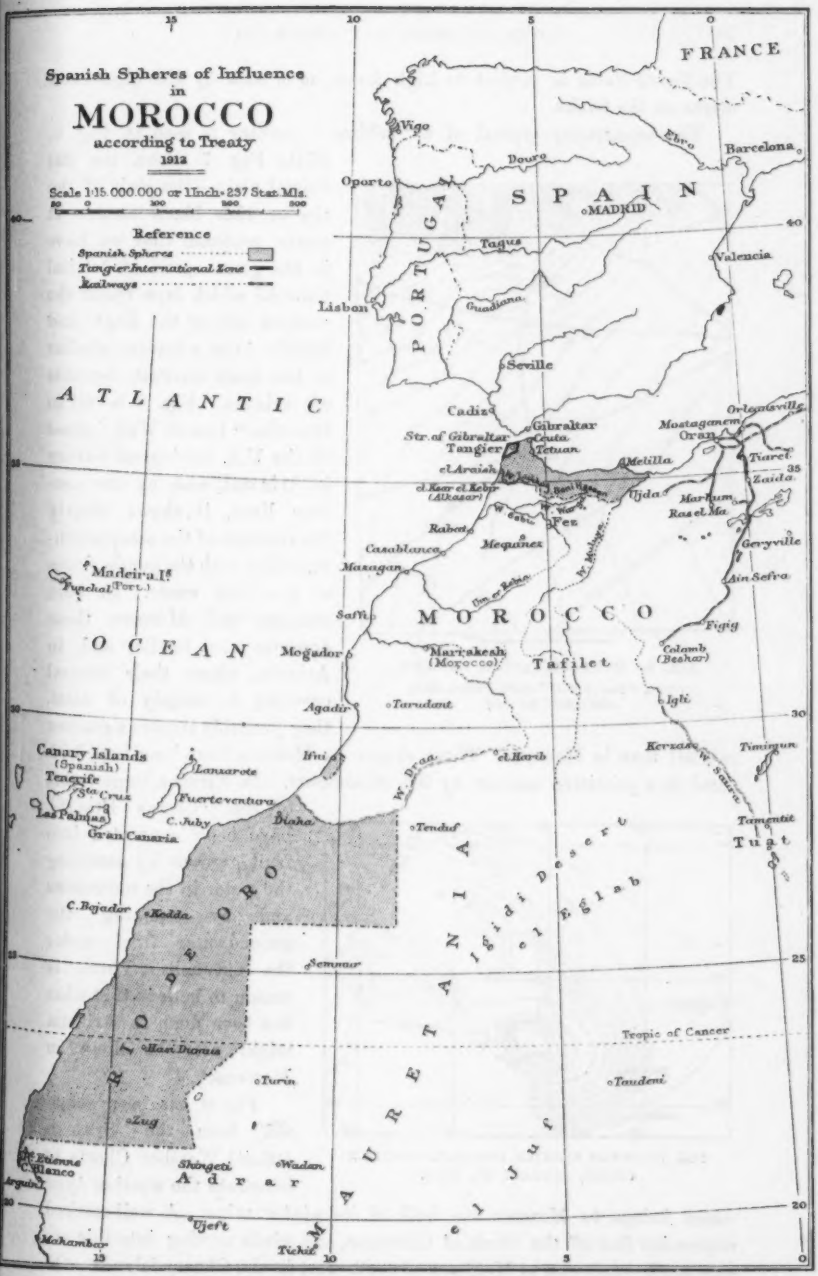
FIG. 5.—IN THE VALLEY OF THE UM-ER-REBIA.
(*Photo: Louis Gentil.*)

FIG. 6.—THE DISSECTED PENEPLAIN IN THE SHAWIA COUNTRY.
(*Photo: Louis Gentil*).

FIG. 7.—PLAIN OF THE "TIRS" NEAR BER RESHID.
(*Photo: Louis Gentil.*)

FIG. 10.—FOREST OF *ARAR*, JEBEL AMSITEN, SOUTH OF MOGADOR.
(*Photo: Louis Gentil.*)

FIG. 11.—FOREST OF CORK-OAK, SHAWIA COUNTRY.
(*Photo: Louis Gentil.*)


Spanish Spheres of Influence
in
MOROCCO
according to Treaty
1912
Scale 1:15.000.000 or 1 Inch = 237 Stat. Mls.
Reference
Spanish Spheres
Tangier International Zone
Railways
FRANCE
SPAIN
PORTUGAL
ATLANTIC
OCEAN
MOROCCO
Vigo
Oporto
Douro
Ebro
Barcelona
MADRID
Tagus
Valencia
Lisbon
Guadiana
Seville
Cadiz
Gibraltar
Str. of Gibraltar
Ceuta
Tangier
Tetuan
Mostaganem
Oran
Orleansville
Melilla
Tiaret
Zaida
el Araish
el Kasr el Kebir (Alcasar)
Ujda
Martimprey
Ras el Ma
Fez
Rabat
Mequinez
Casablanca
Mazagan
Gerryville
Ain Sefra
Madeira Is.
Funchal (Port.)
Saffi
Figig
Mogador
Marrakesh (Morocco)
Tafilet
Colomb (Beshar)
Agadir
Tarudant
Igli
Canary Islands (Spanish)
Tenerife
Lanzarote
Fuerteventura
Ste. Cruz
Las Palmas
Gran Canaria
C. Juby
Diaba
Ifni
W. Draa
el Harib
Kerzaz
Timimun
W. Saura
Tendut
Tamentit
Tuat
C. Bojador
Kedia
RIO DE ORO
Igidi desert
el Eglab
Semmar
Tropic of Cancer
Hassi Diarna
Turin
Taudeni
Zug
MAURETANIA
el Juf
St. Etienne
Villanco
Shingeti
Wadan
Adrar
Ujeft
Mahamba
Tichit

The Um-er-Rebia is subject to high floods, as is seen by the high-water marks on the banks.

The topography typical of a "sokhrat" country is seen in Fig. 6, while Fig. 7 shows the flat coastal plain—the plain of the *tirs* or rich black earth. It seems probable that we have in the great apron of detrital material which laps round the western side of the High and Middle Atlas a feature similar to the thick outwash deposits of Arizona. Fig. 8 is taken from the "Desert Well" sheet of the U.S. Geological Survey in Arizonal, and, by the contour lines, it shows clearly the contrast of the steep mountain sides with the gentle slopes of the rock waste. In both Arizona and Morocco these deposits are fertile, and in Arizona, where their natural covering is largely of cacti, they probably receive a smaller rainfall than in Morocco. These slopes in Morocco have long been irrigated in a primitive manner by the inhabitants. In Arizona large tracts of the "Cactus Desert" have been converted into fruit gardens by damming the water in the mountains and by pumping the groundwater from under the outwash. There is reason to believe that what has been done in Arizona might also be done in Morocco.

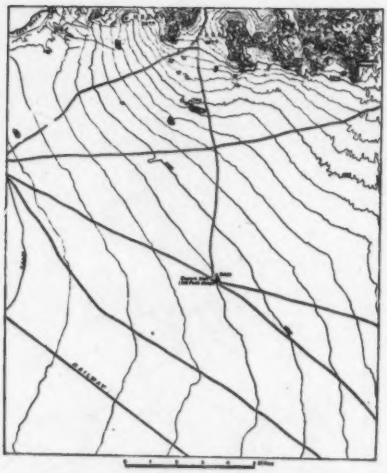


FIG. 8.—OUTWASH SLOPES, ARIZONA.
(From "Desert Well" Sheet, United States Geological Survey.)

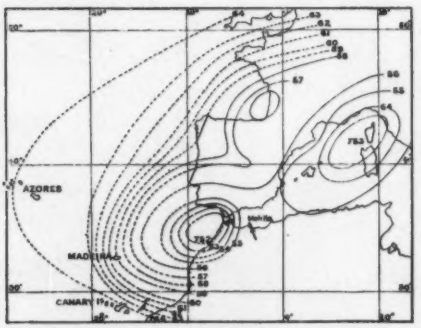


FIG. 9.—FROM SPANISH OFFICIAL WEATHER CHART, JANUARY 27, 1912.

Fig. 9 has been selected from the Spanish Official Weather Charts to illustrate the weather type which brings to Morocco the bulk of its winter rains. A well-marked depression lies off the Strait of Gibraltar, and winds moving into this are seen south-south-east at Melilla, and south-west in the Canary islands. On

FIG. 12.—ARGAN TREE, VALLEY OF ASIF AÏT AMEUR.
(*Photo: Louis Gentil.*)

FIG. 13.—PLAIN OF HAUARA, SUS.
(*Photo: Louis Gentil.*)

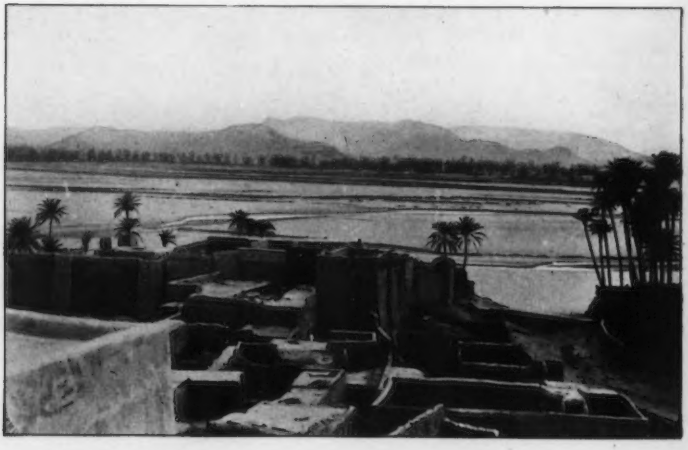


FIG. 15.—AN OASIS IN THE UPPER DRAA.
(*Photo : Louis Gentil.*)

the following day the cyclone had moved into the Mediterranean, to Corsica, and its passage must have caused west and south-west winds, which bring the rain, to blow over the greater part of Morocco.

Where rainfall is considerable (see rainfall map), as it is in the mountains and in the coastal region, forests are found. It is probable that the species which form the most extensive woods are the cedar in the Riff and Atlas; the *Arar* or Thuya (*Callitris Quadrivalvis*) also in the Atlas; the cork-oak on the lower ground; and at the south-west end of the High Atlas and in the Sus plain, the Argan tree. Examples of the last three of these are given in Figs. 10, 11 and 12.

The transition to regions of successively less and less moisture is marked by corresponding changes in the vegetation. Beyond the limits of tree-growth there are woods of high bushes (Fig. 13), many of which are in species the same as those which form the undergrowth of the forests. Prominent among the bushes are representatives of the brooms, cistus, arbutus, pistacea, sumach, and dwarf palms (*Chamærops*). As the moisture decreases the bushes first become dwarfed, and over large areas form that dense cover of scrub—the *macchia*, which is so characteristic of the Mediterranean shores—then the number of species diminishes, and only those persist which can support great drought; such are the *Ziziphus lotus* and the *cacti*. Finally, there are great tracts of arid steppe, both in the Meseta and on the Eastern Plateau, in which a dwarf *artemisia* and the halfa or esparto grass cover wide areas. The steppes, however, in the early spring, after the rains, provide sufficient pasture for large herds of goats and sheep.

The steppe-like conditions of the interior of the Meseta preclude its being used for agriculture to any extent. It is primarily a pastoral country in winter and spring, and practically a desert in summer. Dry farming of a kind has long been in use in the Atlas lands, and if the methods were given the scientific basis which they have in America it would seem that agriculture might be extended far on to the steppes, provided that the result aimed at were the production of one crop for two years' rainfall.*

In the deep-cut valleys of the plateau, of which Fig. 14 may be taken as a type, water is usually to be found, either as a running stream, or more commonly oozing out as springs from the valley sides. This water is extensively used in irrigation and the valley bottoms are often veritable gardens, green with the foliage of olive groves and fruit trees of all kinds. It has been suggested that with facilities for export these valleys might add greatly to the supply of early vegetables and fruit in the markets of Europe.

Fig. 15 is a type of the oases of the Saharan border of Morocco,

* On this see Augustin Bernard, 'Le "Dry-farming" dans l'Afrique du Nord.' *Annales de Geographie*, **20**, pp. 411–430.

watered by the streams as they leave the Atlas to lose themselves in the desert.

The wadys give the life's blood to these oases, but as it does not flow with a steady pulse—only indeed when rain has fallen or snow has melted on the mountains—it follows that the inhabitants do not spend the whole year there. The annual activities of these people, in fact, fall naturally into three periods.

When rain in the hills sends down floods in the wadys—generally speaking in winter—the tribes swarm to the oases, and seize the opportunity of sowing and reaping a crop. Then, when the rains have ceased, and the streams dried up, they betake themselves up on to the plateaus

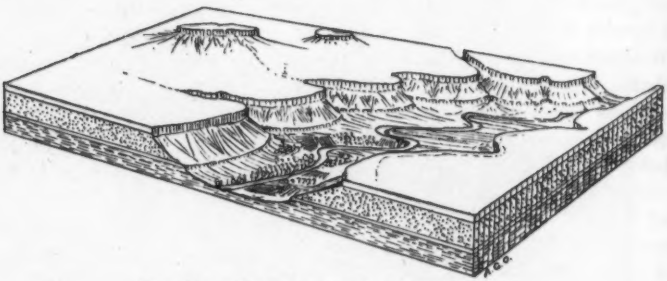


FIG. 14.—FORM OF A VALLEY IN THE MESETA.

and hills, and become wandering herdsmen for the summer. But the great heat of these months has been sweetening and ripening the dates in the palm-groves of the oases, and so every autumn the tribes move down again, with great regularity for the date harvest.

This oscillating existence is such that the tribes living along the Saharan border of Morocco are rightly termed "semi-nomadic."

NOTE.—The principal features of the recent Franco-Spanish treaty are treated in the Record of the Month.

FRANCO-SPANISH TREATY REGARDING MOROCCO.

The above treaty, which was signed in Madrid on November 27, 1912, defines the position of France and of Spain in Morocco.

The features of the Treaty which are most important geographically are mentioned below.

Boundaries.—The Spanish sphere is in two main parts—in the north and south. The frontier of the Spanish northern zone is defined as follows: the River Muluya from its mouth on the Mediterranean to a point 1 km. below Mechra-Klila (*i.e.* some 50 miles from its mouth). From this point the boundary will strike westward to the Jebel Beni Hassen (this part is subject to slight modifications). Further to the west

the line is to keep far enough to the north of the main east-west course of the Wadi Warga to leave the tribes of this valley entirely in the French sphere. On reaching a point not less than 25 km. to the east of the Fez —Wezzan—El-Ksar-El-Kebir road until it meets the Wadi Lukkos, it follows this downstream, but diverging to leave the Jebel Ghani on the Spanish side, it coincides with the parallel 35° N. for the last 30 km. before reaching the ocean.

Thus the Spanish sphere includes practically the whole of the Mediterranean coast of Morocco. France retains in her sphere the southern ranges of the Riff and also the easy route from western Morocco into Algeria, via the Gap of Jaza.

In southern Morocco the Spanish territory of Rio de Oro is extended north to the Wadi Draa. The frontier follows this valley up till it meets the meridian of 11° W. of Paris, which forms the eastern boundary as far south as 26° N. Round the town of Ifni—Spanish since the treaty of 1860—an enclave is formed, having a seaboard extending from the Wadi Noun to the Wadi Bon Sedra, with a hinterland of some 25 km.

A zone is described about Tangier some 140 square miles in area. This is to be an international zone: its status and the nature of its government are not defined.

Other Matters.—Spain is to keep the peace in her sphere, and to help the Moroccan Government to introduce all necessary reforms—administrative, economic, financial, judicial and military. The Spanish zone is to remain under the civil and religious authority of the Sultan of Morocco, and it is to be administered—subject to the control of a Spanish High Commissioner—by a Khalifa. This Khalifa is to be chosen by the Sultan from two candidates put forward by the Spanish Government: he is to reside at Tetuan.

Spain undertakes not to cede her rights, and both Governments agree to build no fortifications on the Strait of Gibraltar.

The practice of all existing religions is to be respected in both spheres. The revenue from taxes and resources of the Spanish sphere are to be devoted to that sphere, and the Moroccan Government is not to be called on to meet expenses of the sphere.

A railway is to be constructed from Tangier to Fęz: this will be the first railway in Morocco. Work is to be begun as soon as possible, starting from both ends simultaneously.

Major Leonard Darwin (Vice-President in the Chair, before the lecture): The name of our lecturer to-night, Mr. Ogilvie, must be well known to the readers of our *Journal*, because it is but a short time since he wrote a very interesting paper on glaciers. Moreover, it is only a few months ago since he read to us at one of our afternoon meetings a paper in which he dealt with all the available information with regard to Morocco. Now, those afternoon meetings are not celebrated for

the largeness of the audiences, and perhaps I might take this opportunity of saying that I cannot help thinking if the Fellows knew the nature of those proceedings there would be larger attendances. It was thought a good plan to ask Mr. Ogilvie if he would kindly extend that afternoon lecture into a paper suitable for one of our evening meetings, because of the great interest which has been aroused in this country on account of the French Protectorate; and this he has kindly undertaken to do. And I am quite sure we shall all listen with interest to the way he deals with this matter, especially when we know he is one who has been educated under Prof. Penck in Berlin, at the Sorbonne at Paris, and now is one of the instructors in the best, or one of the best, of our schools of geography, the School of Geography at Oxford.

Captain H. G. Lyons: In the lectures we have heard in this session, we have had excellent examples of at least two types of geographical description. We have had several papers of the special description, the description of an explorer or traveller whose observations are necessarily restricted to a comparatively small or narrow range of country closely merging on his route, and we have at least one other than this—the paper by Miss Semple, where the general view of a whole district was taken—and although inevitably a special description often contains more new and more sensational facts, there is a great deal to be learned and a great deal of interest to be found in these special descriptions, as we have seen from the paper by Miss Semple and that by Mr. Ogilvie to-night. Perhaps those who are not familiar with its use may have been struck by the modern method of geographical description, the free use of those block diagrams, and the tracing out of the evolution of the present form of the existing surface from its past history; but I hope they have appreciated that it forms a very useful basis for the observations of the present character of the country and its inhabitants. Starting with what we have heard to-night, we may treat in the same way Algeria, Tripoli, and Egypt, the whole of that northern margin of Africa, and fit in the observed facts on such a basis, and so obtain a very clear representation of the surface features. Mr. Ogilvie has alluded to the way in which the Arab inhabitants readily pick out the main forms of structure, and this is characteristic of the whole of the desert areas traversed by nomad tribes across Africa and into Arabia. The Arab language is extremely rich in terms precisely descriptive of what may appear at first to be but small differences in district topography. Where features are few and where buildings are non-existent, such a precise description of land-forms is of enormous practical importance to the nomad dwellers of the region. The cyclonic storms to which he alluded are a very important feature of the climate of the whole Northern Africa, and are intimately related to the distribution of past and present civilization. It is these storms sweeping along the Mediterranean from west to east that supply the scanty rainfall of the coastal area, and the very important question, whether it is a diminishing quantity or not, is very far from being satisfactorily settled. All along that coastal region we have works of Roman civilizations, showing that in those days—in the Roman occupation to which the Chairman has alluded—infinite pains were taken, and were worth taking, to store up the available water-supply for the agricultural development of that narrow region. Mr. Ogilvie also alluded to the scanty amount of our precise knowledge of Morocco, and the same might be said of other portions, and that might lead on to a discussion of an important question in cartography. In our maps we have not yet devised a means of indicating what regions are but scantily known and of what portions we have real and definite knowledge. I am sure we may all congratulate Mr. Ogilvie, and are much indebted to him for this very careful and systematic description of a country which is none too well known.

Major DARWIN (after the paper): Mr. Ogilvie, at the beginning of his paper, told us that information about Morocco was singularly incomplete; but in spite of its incompleteness, you will agree that he has been able to give us a most vivid picture, not only of the geological genesis of this country, but also of the probabilities of its economic development. He was naturally unable in the time available to quote all his many authorities. No doubt many of those are French, but I am glad to think that one of those on whom he had to rely was one of our Gold Medalists: I allude to Sir Joseph Hooker. His name does not seem to take one very far back because of the ripe old age at which he died so recently, and possibly because, till he was well over ninety years of age, he did every day of his life a hard morning's work. But his expeditions in the Atlas mountains took place some forty years ago, when he was no longer young. It was partly for these explorations he received our Gold Medal, and he would have been much pleased if he could have heard the allusions made to the way in which his botanical research had been used in making out the rainfall maps of Morocco. There are, no doubt, many unsolved problems in Morocco which such a study will help us to solve. I have often wondered why it was that the Roman Empire, which spread up to Scotland, made so very little way in Africa. Was it that land transport had to be relied on almost exclusively, and that land transport along the north of Africa was singularly dangerous, with the sea on one side and the keen mountain tribes on the other ready to attack the invaders? Or was it because there really is only a narrow strip of habitable land? But there is another explanation which the lecturer has suggested to me, and that is that the Romans really did go far further south than we have any knowledge of, and this shows how much more there is to be found out yet in these lands. There will be, no doubt, many problems to be solved in that land, and I cannot help thinking that such a survey of the whole country, as we have heard to-night, is a fit preliminary for such work. I am sure we congratulate our lecturer for having put the material together in such a clear and fascinating manner.

ON THE PANAMA CANAL, AND THE FORMATION OF GRAVITATION WAVES IN THE CULEBRA CUT.

By VAUGHAN CORNISH, D.Sc., F.R.G.S., F.G.S., F.C.S., F.R.C.I.

THE annual reports of the Isthmian Canal Commission which have been presented to the library of the Society contain a fund of authentic information on an undertaking of great importance to engineers, geographers, and to all who are concerned with the adaptation of the white race to the conditions of life and colonization in the tropics. Much that has been written lately upon these matters is readily accessible and need not be repeated here, but there is one unlooked-for aspect of the constructive work of special interest to physical geography, and which therefore demands our attention. This is the gravitational upheaval of the compact rocks which form the bottom or floor of the excavation between Empire and Gold Hill in the great Culebra Cut. From time to time during the last four years portions of the bottom, a few hundred feet long and perhaps as much as a hundred feet wide, have risen in a hump or weald often to a total height of

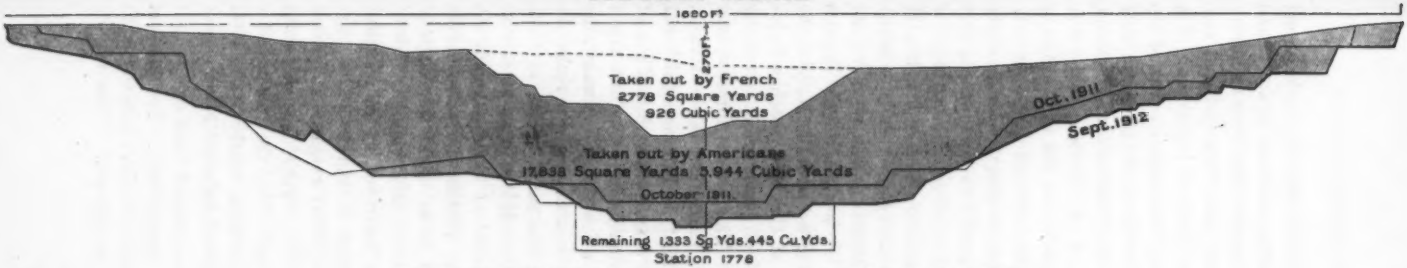
20 feet, once to a height of 30 feet. The upheaval is rapid. In one case it was 9 feet in an afternoon, in another it was 10 feet in ten minutes. The upheavals occur both in the dry and in the wet seasons. The upheaved rock comes up quite dry, and its surface is crevassed. The upheaval is accompanied or more often followed by a subsidence of the bank some distance at the back of it, forming a concave depression with a crevassed surface. Between the crevassed convex upheaval and the crevassed concave subsidence the surface generally remains without deformation. It has happened that in such an intermediate position a locomotive has remained without disturbance upon the rails of a construction track. I examined these phenomena in July and August, 1910, in the wet season, and in April and May, 1912, in the dry season, and have consulted the reports of the Commission from 1899 to 1912 for further light upon them.

Taking the position "mile 36" north of the village of Culebra as central and typical of the bad piece of the Cut, I find that no upheaval is recorded as happening during the French work when the depth on the centre line reached 45 feet. A single slight upheaval occurred in 1909, five years after the Americans began work, when the depth on the centre line was 65 feet. Next year a continuous slope was substituted for the terraced sides, and the bottom was lowered 35 feet, to a total depth of 100 feet on the centre line (and more at the sides). In this year the largest upheavals occurred, and they were very numerous. Next year benches or terraces were again cut in the sides, the slopes were greatly flattened, and the dynamite charges used for blasting were reduced. By the end of this year, during which the bottom was lowered 15 feet to a total depth of 115 feet, the upheavals had almost ceased. Finally, during 1912, maintaining the terraced form of side, working with the reduced dynamite charges, and keeping the flatter slopes, the level was again lowered by about 30 feet, the present depth on the centre line being about 150 feet, with a maximum height at the sides of about 260 feet.

During this year the upheavals recommenced, and though none exceeded 20 feet in height, they were considerable in size and numerous. The amount of material moving into the Cut from the "breaks" above has been very large. The report for the year ending June 30, 1912, which is just out, states that none of them would have prevented navigation. The latest numbers of the weekly Canal Record state that there have been large "breaks" recently. The final depth being now very nearly reached, there cannot, however, be another year in store for the engineers in which any great additional strain can be thrown upon the cohesive strength of the bottom rocks, so that the trouble, though not at an end, will, I think, diminish and ultimately cease.

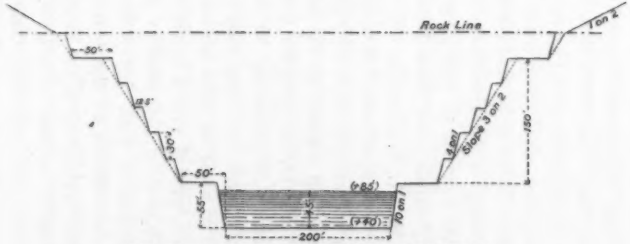
My business, however, is with the explanation of what has occurred, An examination of the two sections shows at a glance how utterly unforeseen was the behaviour of the rocks. The International Board of

PANAMA CANAL



Entire section equivalent to 7,315 cubic yards per linear foot of Canal Prism

CROSS SECTION OF CULEBRA CUT, AT CULEBRA, AT THE POINT OF GREATEST WIDTH TO SEPTEMBER 1912



CULEBRA CUT, AS ORIGINALLY PROPOSED.

Horizontal and Vertical Scale 1:2400 or 1 Inch = 200 Feet

100 50 0 100 200 300

FEET

Consulting Engineers were unanimously of opinion that the rocks would stand stably at a slope of 3 vertical on 2 horizontal even if a sea-level canal were made. Yet the bottom bursts up and the sides cave and break with a depth on the centre line 80 feet less than that of the proposed sea-level canal, and with a slope of 1 vertical on about 3 horizontal. The strata here not being tilted towards the canal, there was no fear of the upper layers gliding upon lubricated under-surfaces, neither have they done so. The point to be noticed is that a body of eminent engineers, American and European, estimated the strength of the rocks to be such that they would be stable at a depth of excavation on the centre line of 245 feet, whereas, in fact, they began to collapse when the depth was only about 65 feet. Numerous borings had been made, so that the quality of the underlying rocks was not unknown. It is hardly to be supposed that experienced engineers would overestimate by 400 per cent. the strength of rock—specimens which they could see and handle. The explanation of their mistake seems to be that certain of the underlying rocks have subsequently undergone deterioration owing to the access to them of rain-water let in by the removal of overlying material. It is stated in the Reports that the upheavals occur where there are seams of weak rock underlying the bottom. Mr. A. B. Nicholls, office engineer at Culebra, who has in his charge the rock specimens, informed me that these seams are in fact strong until they are wetted, when they quickly rot. This view is foreshadowed in an interesting manner by the report of Mr. Marcel Bertrand, of Paris, and Mr. P. Zürcher in Appendix B of the Report of the International Board of Engineers. In preparing for microscopic examination thin slices of rock freshly taken from deep shafts and apparently solid, they had to use oil instead of water, as, after an immersion of a few minutes in water, the specimens crumbled with a touch, even in the case of eruptive rocks, the material separating like marl or granulating like sand. Some of them were interspersed with clayey filaments. Combining these facts with my own observations on the spot, and the record of the relation of the occurrence of upheavals to the depth and other circumstances, I conclude that they were produced as follows. As soon as an underlying seam of lignite or of rock containing clayey filaments or oxidisable sulphide of iron (of which there is much) has its cohesion destroyed by the chemical and mechanical action of percolating rain-water, it begins to flow fragmentally from the position where the superincumbent weight is unreduced towards that where it has been lessened. The crushed and squeezed material transmits pressure in all directions, and when the floor above it becomes thin owing to the lowering of the excavation nearly to the level of the seam, it bursts up the floor. The escape of material leaves a cave under the banks of the canal which then collapse under their own weight as any extensive sheet of rock will if left unsupported. Trouble was anticipated with a weak seam underlying Contractors' hill, where the depth is greater than at mile 36, but there has been no upheaval. This may be

due to the impervious character of the andesitic rock of which the principal mass of the hill is composed.

Upheaval of water-logged soil often occurs where pressure is transmitted by the water from an embankment or in a cutting, but there is no such saturation in the Culebra Cut at the end of such a dry season as that of the winter and spring of 1912, so that, although the mischief is, I think, caused by rain-water, it has acted in a novel and unexpected way, and the upheavals in the Culebra Cut are not caused in the same way as the bulging of swampy ground.

That they are actually gravitation waves in the lithosphere is illustrated by the following case which was told me by Colonel D. D. Gaillard, engineer in charge of the central division, which comprises the Culebra Cut. An upheaval of the bottom, and a collapse of the rock of the bank behind, occurred just north of Gold hill on the east side of the canal. The upheaved hump was removed by the steam-shovel. The bottom again upheaved in the same place, and a second subsidence occurred in the bank at the back of it. The second hump was removed, when the bottom bulged up a third time, and a third subsidence occurred behind. The action was repeated in all seven times on a diminishing scale before equilibrium became permanent.

I do not think that upheavals would have been a marked feature in the Cut if the rock had been merely weak but unstratified, for it would then, I presume, have given way almost entirely at the foot of the bank. A stratified arrangement is precedent to the formation of well-defined surface-waves in the atmosphere and hydrosphere. A columnar arrangement, on the contrary, prevents the formation of surface waves. Thus in the atmosphere wave-clouds are formed when a layer of warmer air travels over a layer of colder air, but when the structure of the air is columnar there are no wave-clouds but piled-up cumulus. When the wind blows directly across the regular ridges of an ocean swell and in the direction of their motion it quickly develops them into great and regular waves. But when the wind is diagonal to the swell the water becomes cut up into pyramids, the vortices of wind have their axes tilted out of their horizontal, the air thus becoming more columnar in structure, and the growth of the waves (as I have often noticed at sea) is very slow.

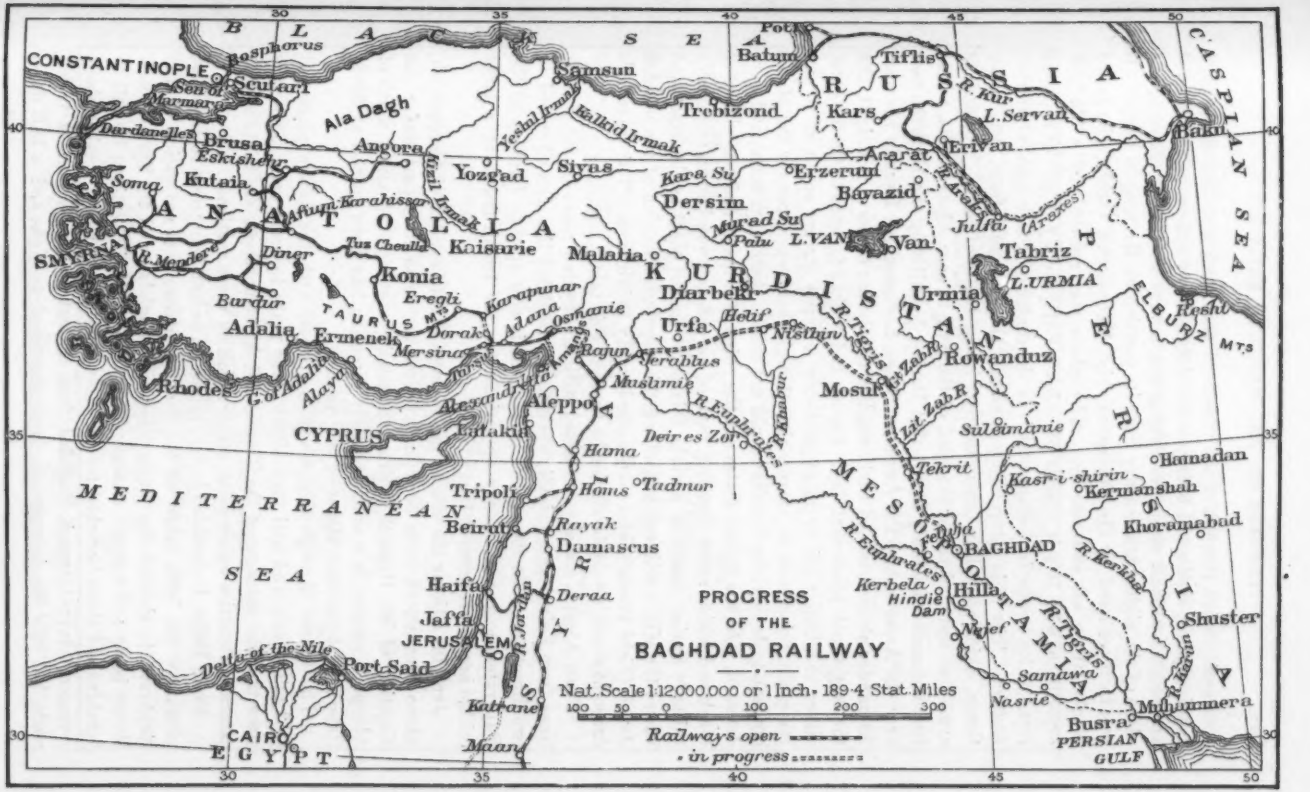
Stratification is the normal structure of the lithosphere, and the strata, originally plane, generally become wavy when disturbed. Wherever an underlying layer is more fluid than those above and below, it tends to flow from the place of greater to that of less pressure, forcing up the superincumbent stratum in the latter and letting it down in the former place with the formation of a waved surface.

PROGRESS OF THE BAGHDAD RAILWAY.

It is well to note that the Baghdad Railway project, so often discussed, is making slow but steady progress towards completion. On the Anatolian highlands, the line has been extended through the northern outliers of the Taurus to Ulukishla, and will shortly be open to Karapunar (Bilemedik), traversing thus far a fairly easy country of open downs and river valley. From Konia to Karapunar is a distance of 182½ miles. On the lower or southern side of the Taurus, the existing Mersina-Tarsus-Adana railway has been incorporated in the Baghdad Railway, and a branch has been made from a point 16 miles short of Adana to Dorak, among the southern outliers of the range. It remains now to connect Karapunar with Dorak, a break of 56 miles, and thus complete the passage of the Taurus; but the section has many natural difficulties, involving much tunnel work in the limestone gorges of the Chakit river, and will probably not be completed for three years. Eastward across the Cilician plain from Adana, the line has been completed to Osmanie on the slopes of the Amanus range, while work has been commenced on the short branch line to Alexandretta. Also plans have been made and submitted to the Turkish Government for the construction of the new port at Alexandretta, in accordance with the terms of the supplementary concession sanctioning the branch line. These include the construction of three docks, a feature not without considerable interest.

The branch to Alexandretta passes through a country full of historical interest. The junction on the main line is at Toprak Kale (Earth Castle), a short way north of a prominent rock rising out of the plain on which are the ruins of a mediæval castle. Just to the south and probably guarded at one period by the castle, are the Amanian Gates (Amanicæ Pylæ), which for half a mile is only 300 yards wide with a level floor, bordered by basalt cliffs about 100 feet high.

The plain of Issus is now entered and the line passes close to Geuzene and some ruins which are possibly those of Epiphanea, mentioned by Cicero and referred to by Pliny as Oeniandus. There are remains of a small theatre, a temple, a church, a gymnasium, a street bordered by columns through which a road ran to Baiæ, and the remains of an aqueduct which brought water from the Amanus. A station, known as Karabasdan Chiftlik, is on the plain near the shores of the Gulf of Alexandretta and near by is the tumulus of Karakaya said to contain the bones of those who perished at the battle of Issus. The stations are at about 6¼ miles' interval, another being Durt Yol (Four Roads), a few miles west of the large village of Chok Merjumen (Durt Yol), the centre of a fertile district watered by the Deli Chai (said to be the Pinarus) and other streams from the Amanus.


BLACK SEA
CASPIAN SEA
CONSTANTINOPLE
Bosphorus
Scutari
Sea of Marmora
Dardanelles
Brusa
Eskisheher
Soma
Kutaia
Ala Dagh
Angora
Yeshil Irmak
Kizil Irmak
Kalkid Irmak
Samsun
Trebizond
Yozgad
Siyas
Karahissar
Afium
ANATOLIA
SMYRNA
R. Meander
Diner
Tuz Chouila
Konia
Karapunar
Eregli
Kaisarie
Malatia
Burdur
TAURUS Mts.
Adalia
Ermeneh
Dorak
Adana
Osmanie
Mersina
Rajun
Jerablus
Rhodes
Gol Adalia
Alayi
Alexandretta
Aleppo
Muslimie
CYPRUS
Latakia
Hama
Deir es Zor
R. Euphrates
R. Khabour
Tripoli
Homs
Tadmor
MEDITERRANEAN SEA
Beirut
Rayak
Damascus
Haifa
Deraa
Jaffa
JERUSALEM
R. Jordan
Delta of the Nile
Port Said
Katrane
Maan
CAIRO
EGYPT
SYRIA
Batum
Tiflis
RUSSIA
R. Kur
L. Servan
Baku
Kars
Erivan
Ararat
Erzerum
Bayazid
Dersim
Kara Su
Murad Su
Palu
L. VAN
Van
R. Aras (Araxes)
Julfa
Tabriz
L. URMIA
Urmia
PERSIA
ELBURZ MTS
Resht
KURDISTAN
Diarbekr
Urfa
Helif
Nisibin
R. Tigris
Rowanduz
Mosul
Lit. Zab R.
Suleimanie
Tekrit
Hamadan
Kasr-i-shirin
Kermanshah
Khoramabad
MESOPOTAMIA
R. Euphrates
Kerbela
Hindie Dam
Hillah
BAGHDAD
R. Kerkha
R. Tigris
Najef
Samawa
Nasrie
Shuster
Muhummera
Busra
PERSIAN GULF
PROGRESS OF THE BAGHDAD RAILWAY
Nat. Scale 1:12,000,000 or 1 Inch = 189·4 Stat. Miles
100 50 0 100 200 300
Railways open
in progress
30
35
40
45
50

Payas station is south of the village of that name and near the present landing-place, which will be improved by the railway company and rendered accessible for small steamers. Payas was a very flourishing place at the close of the eighteenth century from its position on the road to Egypt. It was then occupied by the Turkoman chief, Kuchuk Ali Oghlu, who levied blackmail on all and sundry. The place was reduced by a Turkish expedition, who left it a mass of ruins. But possibly it will now regain some of its former importance, as it is the centre of a rich orange-growing district. The hills now closely approach the coast and form the Syrian Gates, which played an important part in the battle of Issus. Alexander's army had marched round the head of the gulf to near Alexandretta, where its commander suddenly learnt that Darius, by utilizing the Baghche pass over the Amanus and the Amanian Gates, had occupied Issus in his rear. Alexander at once turned back, reached the Syrian Gates at midnight, and the battle took place next day. Darius had pushed forward to the Pinarus, either the Deli Chai or more probably a small stream south of it, and the plain being here so narrow that though there was room for the Macedonians to deploy, the Persians could not utilize their large force, and were defeated. At the Syrian Gates are the ruins of a castle and two pillars of black and white stone forming part of an old gateway known as Jonah's Pillar. Syrian tradition assigns this point on the coast as the exact spot where the whale relieved himself of the unwelcome burden of the prophet Jonah (Nebi Yunus), who then made his way to Nineveh. The traveller's dragoman will no doubt affirm the truth of this tale.

From Aleppo, already connected with the Syrian coast by the French lines from Beirut and Tripoli, work on the Baghdad line has advanced in two directions. To the north-east the line is now open to Jerablus on the Euphrates, and preliminary operations for the construction of a large bridge are in progress at that place

Jerablus adjoins the site of the ancient Hittite capital of Carchemish, where excavations have been in progress for some time past under the direction of Mr. Hogarth. From Muslimie, a station $7\frac{1}{2}$ miles north of Aleppo, a section in a north-westerly direction has been opened as far as Rajun, on the eastern slopes of the Amanus.

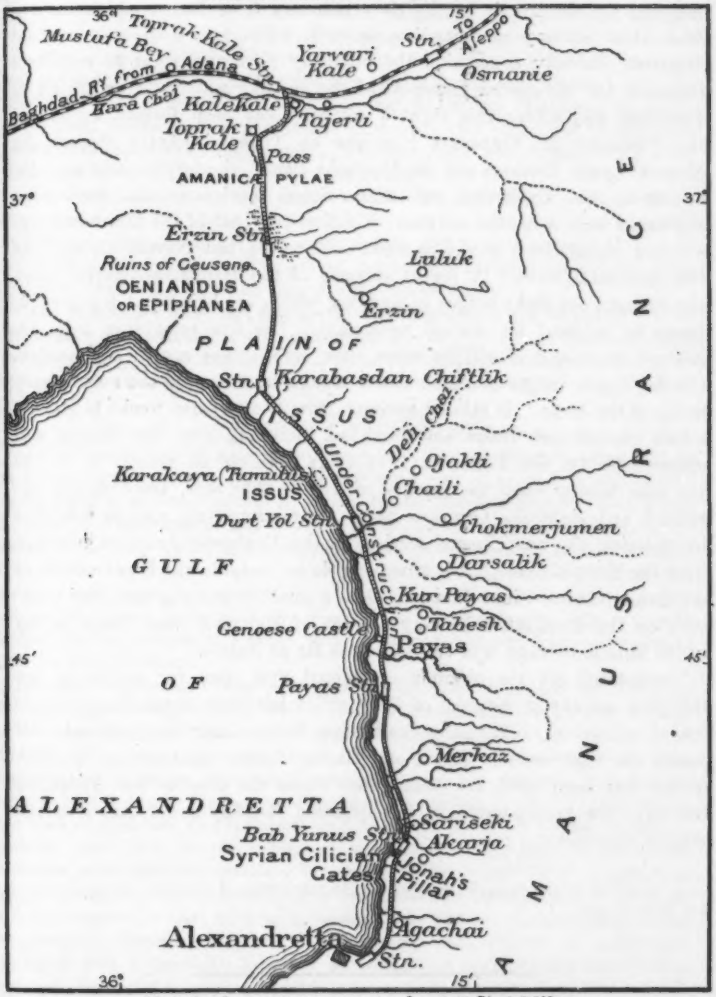
The tunnel through this range to connect with the Adana plain will be 3 miles long, and will take about three years to construct. Thus it is clear that the passages of the Taurus and Amanus ranges are the two great natural difficulties which delay construction on these sections.

From Rajun to Jerablus is $127\frac{3}{4}$ miles. The line being open to Jerablus, advantage has been taken of the fact to utilize the navigation of the Euphrates to shorten the journey between Baghdad and the Syrian coast. Motor boats and a small steamer have been taken in sections by rail to Jerablus and there launched for the river traffic. At present it takes about seventeen days to reach Baghdad from Beirut by the Euphrates valley route, but now the journey has been shortened to eight and a half days,

counting two days from Beirut to Jerablus by train, six days by steamer down the river to Feluja, and ten hours' carriage drive to Baghdad.

Thus, after many years we see the part completion of Chesney's project

BAGHDAD RAILWAY
ALEXANDRETTA BRANCH.



Nat. Scale 1:400,000 or 1 Inch = 6·31 Stat. Miles

5 0 5 10 Miles

of 1837 for the navigation of the Euphrates. Possibly in the season when the river is low some difficulties to navigation will become apparent.

Until the bridge is finished at Jerablus railway construction cannot progress rapidly east of that point, although earthwork has been completed towards Harran. On the section from Baghdad to Mosul construction has been commenced, but progress is retarded by delays in transporting material up the Tigris by the river steamers from Busra, which have to deal with ordinary merchandize as well. By Art. 9 of the original Baghdad Railway concession the company have the right to construct steamers for the special transport of the railway material from Busra to Baghdad, and under this right a company has been formed known as the "Société de Transport Fluviaux en Orient," jointly floated by Messrs. Lynch Brothers and the Deutsche Bank; the former, who are also agents for the Euphrates and Tigris Steam Navigation Co., have been appointed to manage the service. The first tug-boat of the new company, a vessel whose motor power is crude oil, arrived last November, and has had successful trials. A recent steamer of the Hamburg-Amerika Line has brought out eight barges in sections, which are being put together in Busra to be used for towage up-stream. The five remaining tugs are not yet built, and it will be some time before they are in commission. On the Tigris barges must be towed alongside, owing to the many sharp bends of the river. It takes a steamer from two to three weeks to make a round trip between Busra and Baghdad, including time for loading and unloading. On the Tigris, in 1912 there were eleven vessels of 100 to 200 tons towing each two barges of 150 to 200 tons, three flying the British and eight the Ottoman flag. It is interesting, also, to note that by utilizing the new channel formed by the Euphrates near its junction with the Shatt-el-Arab,* it is now possible to navigate the lower course of the former river. Since January, 1912, a small 30-ton tug has plied regularly on the Euphrates, drawing a barge of 100 tons from Busra as far as the Hindie barrage, and two others as far as Nasrie.

Reckoning all the sections completed and open for traffic on the Baghdad railway, a distance of $397\frac{3}{4}$ miles has been finished up to date out of a total of 1029 miles, reckoning from Konia to Baghdad. Of course the line between Konia and Haidar Pasha terminus on the Bosphorus has been open for some years under the title of the Anatolian Railway, now incorporated in the Baghdad Railway under Art. 8 of the original concession.

* As shown in the latest edition of the Society's map of Eastern Turkey in Asia and West Persia.

SOME NEW AND IMPROVED INSTRUMENTS AND APPARATUS FOR GEOGRAPHICAL SURVEYING.*

By E. A. REEVES, F.R.A.S.

At the Southport meeting of the British Association in 1903 I read a paper entitled "Notes and Suggestions on Geographical Surveying suited to Present Requirements;" and in this I attempted to give a brief account of the instruments and methods most suited to the traveller and surveyor who wished to do geographical work of greater accuracy than that which was considered necessary in the days of the early explorers and pioneers. This paper was published in the *Geographical Journal* for January, 1904, and what I have heard from time to time leads me to hope that it has proved useful.

During the nine years that have elapsed since that date, in this, as in all other branches of knowledge, considerable advance has been made, and I propose now to summarize what has been done, and to give a short account of some of the more important new and improved instruments for geographical surveying and route traversing since the date of my previous paper.

The subject is a large one, and covers a wide field, so it will be readily understood that all I can do in this short paper is to give a brief summary, and call attention to rather than describe in detail the various instruments, apparatus and methods of using them that will pass before us in review.

Longitude by Wireless Telegraphy.

Of all inventions of modern times perhaps that of wireless telegraphy is more far-reaching in its effects than any other, and as soon as it was proved to be possible to communicate at a considerable distance without wires it was foreseen that the explorer and surveyor in distant lands ought to be one of the earliest to benefit by it; not merely because he could now be kept in touch of the civilized world, even when exploring the Polar Regions and other distant parts of the Earth, but because this discovery would go a long way towards solving the vexed question of the determination of longitude. Still it is only within the last four or five years that any serious attempt has been made to put this into practice.

In 1908 the French Government drew up an elaborate scheme for definitely determining the longitude of certain stations throughout the French colonies in Africa and Indo-China, with a view to using these later on as points to which the topographical features of the country could be adjusted. The latitude can, of course, be readily determined, but the difficulty is to obtain reliable longitudes, or differences of longitude in regions where no triangulation has been carried out, and far away from telegraph lines. It is easy enough to find the local time, but to determine the corresponding time at the initial meridian with sufficient accuracy for obtaining the difference of longitude is quite another matter. Now, it is here that wireless telegraphy should come in. What is required is that from some transmitting station, the number of which is constantly increasing, signals should be sent and received by a surveyor equipped with a theodolite or other instrument for astronomical observation, a chronometer, and a suitable portable receiving apparatus, such as is now made by the British Telegraph and Electrical Manufacturing Company (179, Clapham

* Royal Geographical Society, November 21, 1912.

Road, S.W.), with which I was recently able to receive the time signals from the Eiffel Tower in Paris. The cost of the receiving apparatus is not more than £6 10*s.*, or including aërial wire and fitting, about £8. With this time signals can be received for over 200 miles, and it is extremely light and portable.

In France, a very serviceable receiving apparatus has been designed by Captain Durand of the Service Géographique de l'Armée, Paris, which has now been thoroughly tested practically.

Fig. 1 is a sketch-map of the world, showing the more important wireless transmitting stations, prepared from a map published by Marconi's Wireless Telegraph Co. Those marked with a triangle ▲ are the powerful long-distance stations, and those with a cross + the proposed British Imperial Scheme stations.

Some interesting experiments for the determination of longitude by wireless telegraphy were carried out in May, 1911, between Brussels and Paris at the request of the King of the Belgians, with a view to the system being adopted in the Belgian Congo; and the results were certainly most encouraging. So far as possible the experiments were conducted under similar conditions, and with the instruments that could be carried in an uncivilized region.

The signals were sent from the Eiffel Tower, and received at the two observation stations between which the difference of longitude was to be determined, which were the garden of the Service Géographique de l'Armée in Paris, and the rose garden of the Palais de Laeken, Brussels. The distance between the two stations is about 160 miles. In Brussels a light receiving apparatus was fitted up, and the observer was provided with an *astrolabe à prisme*, instead of a theodolite, for taking the astronomical observations, as well as with a chronometer. The experiments extended over four days, from May 25 to 28 inclusive, and the results are as follows:—

DIFFERENCE OF LONGITUDE.

May 25.	May 26.	May 27.	May 28.
8 m. 6·391 sec.	8 m. 6·651 sec.	8 m. 6·660 sec.	8 m. 6·630 sec.

The greatest difference between the results will be seen to be 0·269 sec. of time, and the final longitudinal difference adopted was 8 m. 6·58 sec. ± 0·09 sec.

Experiments in the determination of the difference of longitude by wireless telegraphy have also been carried out between Paris and Bizerta, in Tunis. At Paris the time observations were taken in the garden of the Service Géographique de l'Armée, with an *astrolabe à prisme*, checked by other time observations taken with a transit instrument at the observatory; and at Bizerta the observations were made at the arsenal of Sidi Abdallah. The distance between the two places is about 900 miles. Wireless time signals were transmitted from the Eiffel Tower and received simultaneously at each station. The observers exchanged stations midway through the series of observations, in order, as far as possible, to eliminate errors. The first series of observations gave the differences of longitude as 29 m. 52·529 sec., and the second 29 m. 52·47 sec. The mean value was 29 m. 52·505 sec. ± 0·01 sec. At Paris the time observation pillar of the Service Géographique was 0·08 sec. west, and at Bizerta it was 0·04 sec. east of the receiving station at the place, so that the actual difference of longitude between the two stations from the wireless telegraph determination was 29 m. 52·385 sec. ± 0·01 sec.

The true difference of longitude between these two places (as taken from the

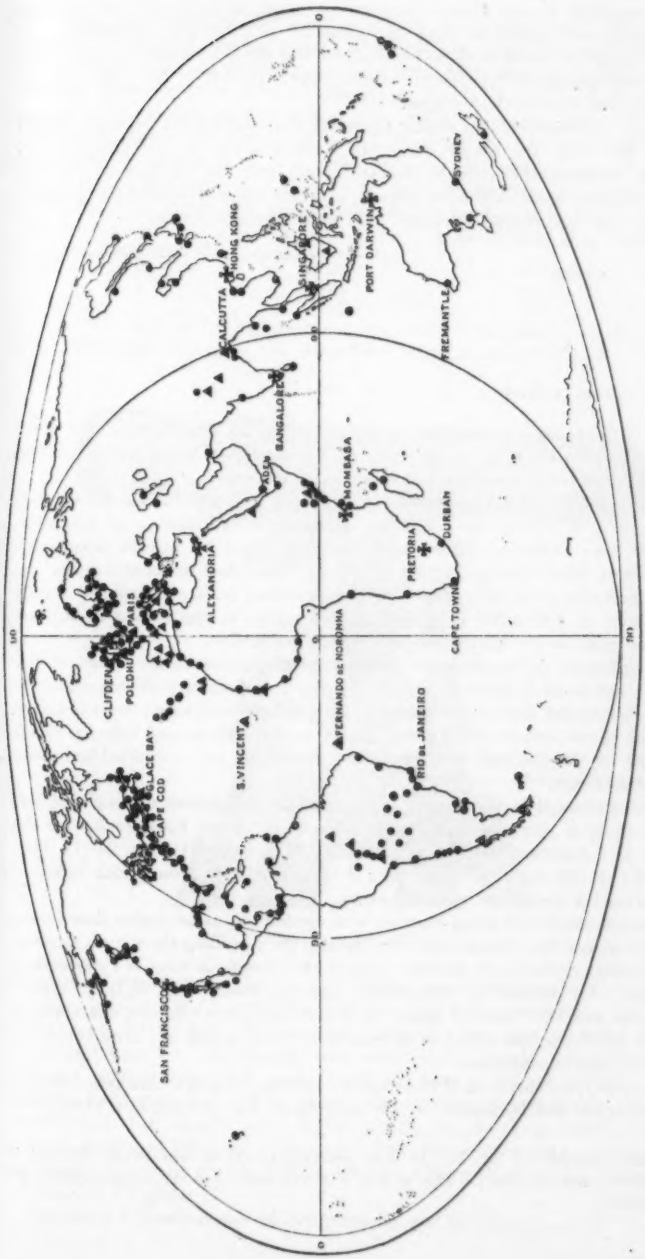


FIG. 1.—MAP OF THE WORLD SHOWING PRINCIPAL WIRELESS TELEGRAPH STATIONS.

latest large-scale French Government survey maps) is practically the same as this, and the error cannot be more than about 0·1 sec., and is probably less.

One important result of these experiments was the determination of the time of the propagation of the electric waves, which proved to be 0·005 sec., or practically the same as that of light.

Further experiments of a similar character were carried out between August 12 and 29, 1911, the object being the determination of the difference of longitude between the Paris Observatory and the Pic du Midi de Bigorre, in the Pyrenees, about 435 miles distant, in which the star altitudes were again observed with an *astrolabe à prisme*. The results were as follows :—

	m.	sec.	Weight.
August 12	8	46·91	0·5
,, 17	8	46·96	1
,, 26	8	46·86	1
,, 28	8	46·67	2
,, 29	8	46·61	2
Mean (weighted)	8	46·74	

This is the position of the observatory of the Pic du Midi.* When the small corrections are made to bring the value up to that of the triangulation station, the final difference of longitude becomes 8 m. 47·07 sec.

The difference of longitude between the two places as given in the *Description Géométrique de la France*, that is to say, the triangulation difference of longitude, is 8 m. 47·2 sec., which is 0·13 sec. more than that found by wireless telegraphy. This gives an error of about 142 feet in 435 miles, or 1 foot in about 3 miles.

The probable error in longitude by triangulation on a geographical survey in a march of 300 miles in mountainous country in the tropics is at least 1 foot in 1 mile, so the comparison here is very favourable.

The difference of longitude by ordinary telegraph now forms a part of this Society's course of instruction, and in this an error of about 0·15 sec., or, in our latitude, about 185 feet, is not unusual. This difference of longitude is obtained by means of two sets of five signals, one in each direction, and using a 5-inch theodolite for the east and west star time observations, and a sidereal and mean time chronometer.

Those interested in the subject of wireless determinations of longitude will find accounts of the operations here referred to in the *Comptes Rendus des Séances de l'Academie des Sciences*, No. 9 (28 Août, 1911), No. 24 (11 Dec. 1911), No. 4 (22 Jan. 1912), and No. 8 (22 Fev. 1912), from which much of the information here given has been taken.

Experiments for the same purpose were carried out at an earlier date in the Japan navy, and Mr. Nakano describes devices for recording the signals received from a distant station in an account given in the *Comptes Rendus de l'Association Géodésique Internationale* (p. 246, 1909). One important result of these experiments was that the "current time," as determined from observations made in opposite directions, was found to be extremely small, which has since been confirmed by later experiments.

So far only the obtaining of longitude by wireless telegraphy has been referred to, but may it not be possible before long to fix the position of a place, both

* The longitude of the Pic du Midi observatory (Connaissance des Temps) is 8 m. 46·8 sec. west of Paris, which is only 0·06 sec. more than the wireless difference of longitude.

in latitude and longitude, by this means? It all depends upon the accuracy that can be obtained, but the scheme which has been developed lately for determining the position of a ship at sea may perhaps possess possibilities for this purpose where distances are not very great, if only it can be made accurate enough. By means of the Bellini-Tosi wireless compass, operated by the Marconi Company, the bearing of any known wireless stations within range can be ascertained, and so it is possible to fix the position of the ship by intersection. This method, if it could be made practicable, would be of great service in polar exploration for determining the position of an exploring vessel where great accuracy is not required, even if it should not give results good enough for ordinary geographical surveying.

The Zeiss Level.

For the purpose of accurate levelling there is doubtless, at the present time, nothing better than the new Zeiss level, shown in Fig. 2. This in-

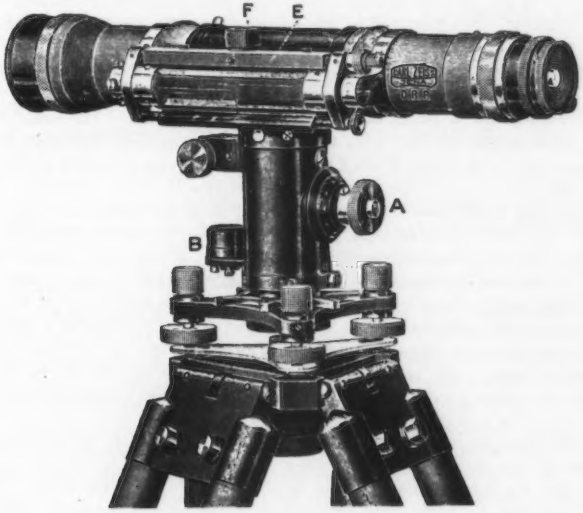


FIG. 2.—ZEISS LEVEL.

strument is manufactured by the well-known firm of mathematical instrument makers, Carl Zeiss & Co., of Jena, and has now been in use for a few years. It has been constructed on the most scientific lines, and possesses several advantages over the "Y," dumpy, and other ordinary levels. By an ingenious reflecting arrangement it is easy to see the level bubble at the same time that the reading of the staff is taken. The instrument is only approximately levelled with the circular level B, by turning the levelling screws, and the accurate setting of the level is done by a fine slow-motion screw, A; and when the bubble E is in its central position the two ends of it are seen to coincide by reflection in the prism F.

The level E is at the side of the telescope, and to eliminate errors can, with

the telescope, be turned over in a collar so that it is first to the left and then to the right of the telescope, in addition to which the eyepiece can be placed at either end of the telescope tube. The telescope is focussed by a movable lens in the centre of the tube, and the adjustments are easily tested, and when once set right rarely get out. All errors are eliminated, and adjustments tested, by taking a set of four readings, two with the eyepiece on one end of the telescope, but the level first to the left and then to the right, and afterwards two more readings with the bubble to the left and right, but with the eyepiece on the other end of the telescope, the whole instrument being turned round on its centre and the prism reversed.

It is not necessary to take these four readings for actual levelling, and in practice one reading with the level on one side only is often taken, and the telescope and level reversed only occasionally to see that no error is taking place.

The level can be completely adjusted from a single station without reference to any previous adjustment. The operation for this is as follows: Set up vertically a correctly divided staff at a distance of about 50 yards, take readings with the instrument in all the four positions described, with the level in the centre of its run throughout. Set the level to the mean of these four readings by the slow-motion screw A, and then bring the bubble to the centre of its run by its adjusting screws, turning these slightly until the two ends of it are seen to coincide in the prism.

The Zeiss level is made in various sizes and weights. The smallest size, No. 1, only weighs 8½ lbs., with tripod and case complete, and costs £14 10s. The telescope of this portable little level has a magnifying power of 20 diameters, and a bubble of which the value of one division of 2 mm. is 20″. For the most accurate work, however, a larger size is of course preferable, and No. 3, the one here shown, is that now being used by the Ordnance Survey for exact levelling. In general arrangement and design it is, as regards its main features, similar to the smaller size, No. 1, but is naturally capable of greater accuracy in reading and result. No. 3 has a telescope of a magnifying power of 36 diameters, weighs altogether with its tripod, 25 lbs., and costs £27, or £32 if fitted with special micrometer for extra fine reading. The cross wires can be used as stadia wires for subtense work, and by their means distances can rapidly be obtained, as with an ordinary tacheometer. The size of the case containing this No. 3 level is 15 × 9½ × 4 inches.

Captain Henrici, R.E., of the Ordnance Survey has recently given considerable attention to the matter of running lines of accurate levels with various instruments, and for this purpose he has lately used No 3 Zeiss level. He has kindly favoured me with some particulars of the results obtained, and I feel sure it will be interesting to learn what they are.

With ordinary single levelling, using one staff (swinging), his men have been getting with a 14-inch Y level, a probable error of about 0·02 foot per mile, based on formula—

$$\text{p.e.} = 0{\cdot}6745\sqrt{\frac{\Sigma E^2}{\Sigma M}}$$

where E is the closing error of a 'circle,' and M the distance round. The circles average about 5 miles.

Using the Zeiss No. 3 (large size) instrument, and two staves held upright, the probable error is often about 0·01 foot per mile; but this is largely due to staff errors.

For double levelling he calculates that with a staff having a probable error for

any division of 0·00025, and the Zeiss No. 3 level, he should get a probable error per mile of 0·002 foot or a little over, and is getting 0·0015 to 0·0032 foot, mean 0·0023. If he could double the accuracy of the staff he would not expect to reduce this much. By using the new vernier attachment he would expect (staff p.e. 0·00025 per reading) a p.e. of 0·0015 foot per mile (more on steep ground), or by doubling the accuracy of the staves about 0·0011. These theoretical figures ignore errors due to refraction and instability of staff supports. He has not yet had sufficient experience to say how near this he is getting with the 'vernier' attachment, as the instability of the staff supports appears to be very appreciable when this degree of accuracy is approached.

The probable error for double levelling is calculated from formula

$$\text{p.e.} = 0{\cdot}6745 \sqrt{\frac{\Sigma\Delta^2}{4M}}$$

where Δ is the discrepancy between the forward and back levelling between bench-marks, and M is the total mileage double levelled.

There have been stretches of some 5 miles where the low figures given by the theory have been reached, but then there comes a bad space which upsets it.

If the vernier is used (this is only for 'precise' work), the staff should be divided by lines with 5 mm., or 0·02 foot spaces. For rougher work any ordinary staff will do. It must be borne in mind that any wooden staff may change its length by three or even five parts in 10,000 of its length in the course of a season; this is of importance for precise work, representing $\frac{3}{10}$ to $\frac{5}{10}$ foot in 1000 feet.

It is generally agreed by all who have had experience with the Zeiss level that it possesses many advantages, is much easier to level, and quicker to work than ordinary patterns. It is easy to adjust, and keeps in adjustment remarkably well.

The Precise Level of the U.S. Coast and Geodetic Survey.

The precise level, after the pattern designed by the U.S. Coast and Geodetic Survey (Fig. 3), and used for exact work in that country, is now also coming into more general use where accuracy is required. The instrument is more convenient to use than ordinary forms, and by an ingenious arrangement a clear view of the two ends of the air-bubble in the level is obtained through an eyepiece situated on the left of the eyepiece of the main telescope, and at binocular distance from the latter, which distance can be adjusted to suit the eyes of the surveyor. Thus, as in the case of the Zeiss level, the position of the air-bubble in the level is under observation up to the moment of reading the levelling staff, which is a decided advantage. The cross wires are fixed, and the instrument permanently placed in correct collimation by the makers. If both back and fore readings are taken to staves at about equal distance, there is little difficulty about the adjustments, as of course the errors are equal, and the difference correct. Another point greatly in favour of both this pattern and the Zeiss level, is that it is unnecessary to waste time attempting to level accurately with the foot screws, as all that is required with these is to level approximately so as to bring the bubble within range of the finely threaded screw near the end of the telescope with which the final levelling is completed. This instrument, although it has been well known in the United States for ten or twelve years, and used by the Surveys of India and Egypt, has not been used much in this country; but Messrs. Watts & Son, Messrs. Cooke, and others have made several of the same pattern, and could give all particulars to any one interested. As regards the

accuracy of exact levelling it appears that the greatest error indicated by the circuit closures in any line in about 20,000 miles of precise levelling executed by the U.S. Coast and Geodetic Survey and other organizations, is about $\frac{1}{10}$ inch, or

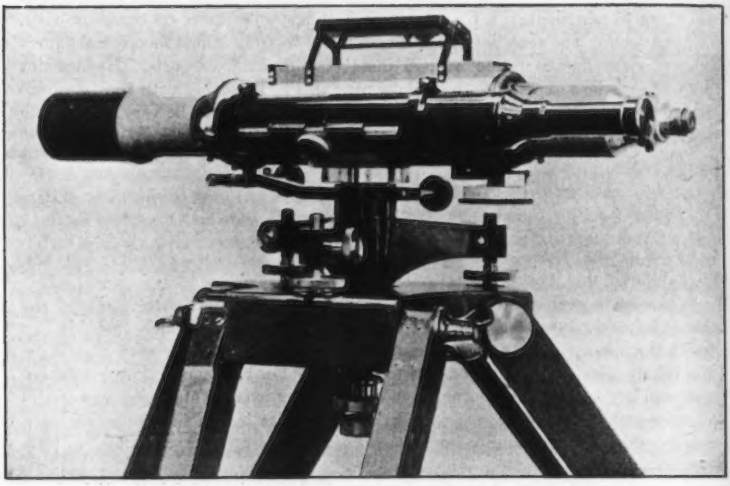


FIG. 3.—UNITED STATES PRECISE LEVEL.

an average of 0·0083 foot, in 1 mile; with the Coast Survey level here described the results reached have been much closer than this. An account of the United

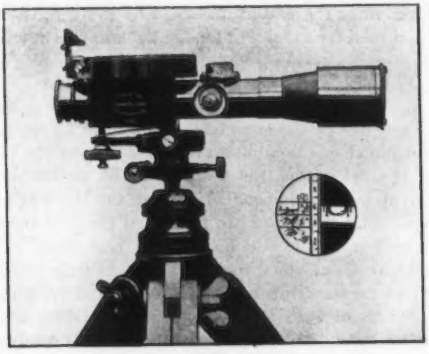


FIG. 4.—WATTS'S PORTABLE LEVEL.

States precise level, and work done with it, is given in Ingram's 'Geodetic Surveying' (McGraw-Hill Book Co., New York, 1911).

Messrs. Watts & Son, who make the large-size level of the U.S. Coast Survey pattern, have recently brought out a small portable level on the same principle, and one of these instruments is shown (Fig. 4). This instrument should be

useful, and is certainly inexpensive, only costing £6 to £7, while the larger level is about £60. I understand that good work can be done with this little instrument.

Plane-tables and Folding Alidades.

It is interesting to notice that the plane-table is becoming more used in our colonies, and a good proof of what can be done with this instrument is the new survey of Uganda on the scale of 1 : 250,000, upon which it was extensively employed for mapping the topographical features which were adjusted to the previously determined triangulation points, and I think it must be admitted that this is an excellent example of mapping—perhaps the most complete of its kind yet carried out. It is to be hoped that the example will be followed elsewhere.

There is, of course, nothing new about the plane-table itself, and its principal features are familiar to all. The simpler it is kept the better, and it is well perhaps not to encourage any attempt at so-called improvements that tend to

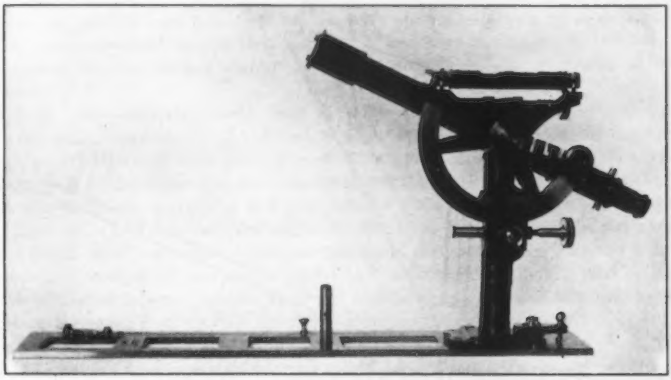


FIG. 5.—FOLDING TELESCOPIC ALIDADE.

complicate the instrument. Some of the Continental forms are needlessly elaborate and complicated, and in recent times there has been perhaps rather an inclination with us to follow in the same line. It is useless to think of turning the plane-table into an accurate theodolite; still, for all that, it is certainly a great advantage to have a simple telescope with cross wires instead of the ordinary sighting alidade. For this purpose, some years ago I devised an alidade with a telescope on a folding pedestal, and a small vertical arc, which has been found very useful in many parts of the world. This is shown in the R.G.S. 'Hints to Travellers' (p. 58). Colonel Close added to this folding telescopic alidade, later on, a parallel ruler arrangement, such as used in Swiss forms, which greatly simplifies the setting of the ruler on to a station mark on the board when the telescope is sighted on to a distant point; and since then a larger vertical circle and a more accurate levelling arrangement for obtaining angles of altitude have been fitted. This plane-table alidade is described in Major Guggisberg's 'Handbook for Surveying in Southern Nigeria,' and shown in Fig. 5, taken from a photograph supplied by Messrs. Cary, Porter, who make this special form.

New Plane-table Clinometer.

For obtaining heights on a plane-table survey the little instrument known in England as the Indian Survey clinometer is frequently used. With this differences of heights are obtained by reading off the tangent of the angle of elevation or depression, scaling the distance, multiplying the two together, and then, unless the map is large enough for the scale to be in feet already, turning the final result into feet; or, after measuring the angle with the clinometer and taking the distance from the map, scaling off the height from a specially constructed scale afterwards. All this sounds simple enough, and it does not take very long after a man has got well into practice; but when the heights of a large number of points are to be fixed these operations become lengthy and

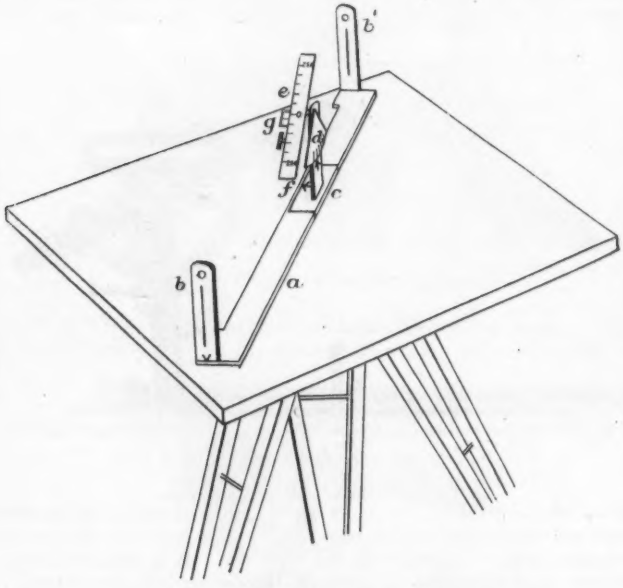


FIG. 6.—NEW PLANE-TABLE CLINOMETER.

tedious, in addition to which there is always a chance of making slips both in the reading of the tangent scale and in actual multiplication.

To shorten this operation, and to obtain greater accuracy, I have recently designed a new form of plane-table clinometer (made by Casella) for use with a telescopic alidade or one with ordinary sights; and by means of this, heights, or rather differences of height, can be read off in feet with considerable accuracy at a glance, without any computation except the occasional adding of a 0 to the figures on the scale. This is shown in Fig. 6. By a simple arrangement the clinometer can be readily adjusted to the scale of any map, and it has the further advantages of being inexpensive, strong, and portable; further, it can be easily fitted to any alidade. The following description will, I hope, make the construction

and principle clear: *a* is an ordinary alidade of which the upright sights are *b b'*; *e* is a scale of feet for the R.F. or natural scale, of 1 : 1000, upon which slides a vernier and horizontal cross wire *g*. This scale of feet can be rotated on its axis, at the opposite end of which is a small arc, *d*; *c* is an upright pedestal carrying the scale of feet and arc, and the whole can be moved along the alidade and placed in any required position. There is an arrow-pointer *f* on the base of the pedestal, coming exactly under the axis of *e*. The arc *d* has marked upon it certain natural scales or R.F.'s, and when it is desired to use the instrument the first thing to do is to set this to the scale of the survey, or to some convenient even decimal multiple of this. For instance, suppose the scale of the survey to be 1 : 10,560 (the scale of the 6-inch Ordnance Map), then $\frac{1}{10}$ of this would be 1 : 1056, which would be that to which the arc is set. Then, with the mark at the base of the sight *b* placed over the surveyor's position on the plane-table, the clinometer is moved along the alidade until the arrow *f* is opposite the point or station on the board of which the height is required. When this is done, and the alidade carefully levelled, the sights are directed on to the distant point, the sliding horizontal wire on the scale of feet is moved up or down the scale until it accurately intersects this point, and then the height in feet above or below the surveyor's station is immediately read off by means of the vernier.

In the case above supposed, since the scale of the map is 1 : 10,560 and that set on the clinometer arc $\frac{1}{10}$ of this, or 1 : 1056, the height read off must be multiplied by 10 to get the real difference of height required, which merely means adding a 0 to the right of the number read off the scale of feet. If the scale of the map had been 1 : 125,000 or 1 : 250,000 the arc would have been set opposite 1 : 1250 or 1 : 2500, as the case might be, and then the clinometer moved along the alidade until the arrow *f* was ten times the distance of the point of which the height is required, and one 0 added to the difference of height read off the scale of feet as before. A scale of inches and tenths is given on the alidade for setting the mark *f* on the clinometer to ten times the distance.

This clinometer is also specially useful for determining the height of the station of the surveyor from one that has previously been found. To do this, all that is necessary is to read off the difference of height found and add or subtract this difference, as the case may be, to or from the known height, and the result is the height of the surveyor's station. The principle of the clinometer will be readily understood from Fig. 7.

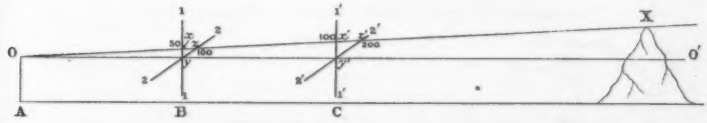


FIG. 7.—PRINCIPLE OF NEW PLANE-TABLE CLINOMETER.

Let X be a distant point, say hilltop; A, surveyor's station; OO', horizontal line; O, position of eye; B, first position of clinometer on alidade at distance AB on alidade; C, second position of clinometer equal to twice the distance AB.

When the alidade is at B, suppose the height scale to be vertical, as 1, 1, and the R.F. on the circular arc to be set at 1 : 1000. Then it is clear that the line of sight, OX, to the top of the hill, will cut the height scale at *x*, or say at the

reading of 50 feet. Now, suppose the R.F. changed to 1 : 2000, then the height scale will occupy the position 2, 2, and the 100-feet division on the scale will be projected at x instead of the 50 feet as before. The positions of the R.F.'s on the scale are have been computed so that when set to 1 : 2000, 100 feet shall be projected to just half the height represented by it when the R.F. is set to 1 : 1000.

Suppose now the clinometer to be moved to C, twice the distance from A that it was when at B. Then the triangles Oxy and $Ox'y'$ are similar, and $Oy(=AB)$: $Oy'(=AC)$: : xy : $x'y'$, and since $AC = 2AB$, $x'y' = 2xy$ and $y'z' = 2yz$. That is to say, the 100 feet at B reads 200 feet at C.

In order to arrive at some definite idea of the accuracy that might be expected with this clinometer fitted to an ordinary alidade, I have recently had some work done with it in the neighbourhood of Redhill and Reigate on the Ordnance Survey sheets on the scales of 6 inches, 1 inch, $\frac{1}{2}$ inch, and $\frac{1}{4}$ inch to a mile. The distances of the various points determined varied from about $\frac{1}{2}$ mile to just over $4\frac{1}{2}$ miles; and so far as I can tell from the contours on the maps and bench-marks, the heights obtained cannot be more than 1 to 2 feet in error for the nearer points, such as 1 to 2 miles, and about 6 feet for a point $4\frac{1}{2}$ miles away. In fact, I must confess the accuracy exceeded my expectation. Some of the heights were taken by myself, others by a pupil, and the remainder by an assistant. The initial height accepted was that of the top of Redhill Common, which is given on the 6-inch Ordnance Map as 475 feet.

The correction for curvature and refraction need hardly be taken into consideration with clinometer heights, at any rate when the instrument is used with an ordinary sighting alidade, as the distances can then never be very great. In a distance of 5 miles this correction would only amount to about 14 feet. However, when the telescopic alidade is used and points a long way off are observed this correction should be taken into consideration. The $\frac{4}{7}$ rule, as it is called, is quite good enough for the purpose, and a table of these corrections is given on the alidade. (This rule is: $\frac{4}{7}$ of the square of the distance in miles equals the correction in feet.)

By this rule a correction was found for the more distant points referred to, and applied to the clinometer readings.

I have worked out the probable errors from five consecutive readings of the same point for the maps on different scales, and give them below.

6-INCH ORDNANCE SURVEY SHEET.

Suspension Bridge to Redhill Common. Distance $1\frac{3}{4}$ miles.

Height in feet.	v	v^2
480	+2·4	5·76
476	−1·6	2·56
478	+0·4	0·16
476	−1·6	2·56
478	+0·4	0·16
5)2388		11·20
477·6		

$0{\cdot}6745\sqrt{\frac{11{\cdot}2}{4}} = 1{\cdot}12$ feet. Probable error of a single reading.

$0{\cdot}6745\sqrt{\frac{11{\cdot}2}{5(5-1)}} = 0{\cdot}50$ foot. Probable error of arithmetic mean.

1-INCH ORDNANCE SURVEY SHEET.

Suspension Bridge to Redhill Common, $1\frac{3}{4}$ miles distant.

Height in feet.	v	v^2
477	$-1{\cdot}4$	1·96
479	$+0{\cdot}6$	0·36
479	$+0{\cdot}6$	0·36
479	$+0{\cdot}6$	0·36
478	$-0{\cdot}4$	0·16
5)2392		3·20
478·4		

$$0{\cdot}6745\sqrt{\frac{3{\cdot}2}{4}} = 0{\cdot}60 \text{ foot.} \quad \text{Probable error of a single reading.}$$

$$0{\cdot}6745\sqrt{\frac{3{\cdot}2}{5(5-1)}} = 0{\cdot}27 \text{ foot.} \quad \text{Probable error of arithmetic mean.}$$

½-INCH ORDNANCE SURVEY SHEET.

Redhill Common to Wray Windmill. 0·9 mile distant.

Height in feet.	v	v^2
402	$-2{\cdot}8$	7·84
405	$+0{\cdot}2$	0·40
405	$+0{\cdot}2$	0·40
406	$+1{\cdot}2$	1·44
406	$+1{\cdot}2$	1·44
5)2024		11·52
404·8		

$$0{\cdot}6745\sqrt{\frac{11{\cdot}52}{4}} = 1{\cdot}14 \text{ feet.} \quad \text{Probable error of a single reading.}$$

$$0{\cdot}6745\sqrt{\frac{11{\cdot}52}{5(5-1)}} = 0{\cdot}51 \text{ foot.} \quad \text{Probable error of arithmetic mean.}$$

¼-INCH ORDNANCE SURVEY.

Suspension Bridge to Redhill Common. $1\frac{3}{4}$ miles distant.

Height in feet.	v	v^2
693	$+1{\cdot}2$	1·44
695	$+3{\cdot}2$	10·24
690	$-1{\cdot}8$	3·24
688	$-3{\cdot}8$	14·44
693	$+1{\cdot}2$	1·44
5)3459		30·80
691·8		

$$0{\cdot}6745\sqrt{\frac{30{\cdot}8}{4}} = 1{\cdot}87 \text{ feet.} \quad \text{Probable error of single reading.}$$

$$0{\cdot}6745\sqrt{\frac{30{\cdot}8}{5(5-1)}} = 0{\cdot}84 \text{ foot.} \quad \text{Probable error of arithmetic mean.}$$

Watches and Chronographs.

While the introduction of the invar tape has transformed all previous ideas concerning base-line measurement, an alloy of nickel and steel of somewhat different proportions has been introduced by M. Guillaume into the construction of the balance of chronometers and watches, with results that appear to be

most satisfactory. I do not know how far anything of the sort has been done in this country, but on the Continent, and specially in Switzerland, this metal alloy has been introduced in chronometers and watches with most promising results.

I have recently seen the latest reports of the Neuchatel Observatory tests, as well as an extract from the Kew report showing the performance of the five watches which gained the highest number of marks during the year 1911. The latter is given below. The first two of these watches are made by Ditisheim, of La Chaux de Fonds, and have the new Guillaume balance; and a note from the superintendent's report at the bottom states that the first place was taken by No. 34,122 by this maker, with 94·8 marks out of 100, which is only 0·1 below the highest record of previous years (94·9), which was also by M. Ditisheim. The best result of all is that just obtained at Kew for a watch with the new balance, also by Ditisheim, with 96·1 out of 100 marks. This is the highest record ever obtained by any watch.

Name of the maker.	No. of watch.	Difference between extreme gaining and losing rates, secs.	Marks awarded for			Total of marks awarded out of 100
			Daily variation of rate, 0–40	Change of rate with change of position, 0–40	Temperature compensation, 0–20	
Paul Ditisheim, La Chaux-de-Fonds	34,122	1·75	36·1	39·0	19·7	94·8
Paul Ditisheim, La Chaux-de-Fonds	36,120	2·0	36·1	37·6	19·4	93·1
Patek, Philippe & Co., Geneva	153,525	2·5	35·1	38·3	19·7	93·1
Golay Fils & Stahl, Geneva	30,605	2·25	34·6	38·5	19·9	93·0
Vacheron & Constantin, Geneva	327,854	2·25	35·0	38·1	19·6	92·7

Mr. Agar Baugh kindly lent me one of these watches, and this I carried in my pocket for about a fortnight, testing it carefully against the time signal at the Society house. I found its performance to be most regular and in every respect satisfactory, the daily rate being just under one second gaining. This watch is the second on the Kew list, and obtained 93·1 marks out of 100. With the exception of the watch with 94·9 marks previously referred to, which was a "tourbillon," all were plain levers.

What is required in a watch for the geographical surveyor and explorer is not only that it should be able to obtain a good certificate at Kew, but that it should be suitable for carrying in a rough country without changing its rate or getting out of order; and this is where the difficulty comes in. I have known more than one watch gain a good certificate, but be quite unreliable when carried by a traveller on an expedition. So far I am not aware that the watches with the Guillaume balance have been put into water and dust tight cases, but I understand that in the future this will be done when desired.

For the geographical surveyor in new regions where there is no triangulation and where chronometric differences of longitude have still to be determined, the possession of a good timekeeper is, of course, important; and it must be confessed that on the whole the so-called "half-chronometer" watch in the Society's water-tight case, made by Blockley and several other firms in this country, have been found to give very satisfactory results in the hands of travellers who have

known how to take care of them. Of course there have been exceptions when for no apparent reason a watch has not been a success, but generally speaking, this has been the case.

As regards the regularity of the travelling rates of watches with the Guillaume balance as compared with others of first-class quality with the ordinary compensation, it is perhaps at present too early to come to a final and satisfactory conclusion; but there is no doubt that the evidence so far tends to favour the Guillaume balance watch.

Those interested in this matter, and desirous of investigating it, cannot do better than consult the tables of watch rates and comparisons of recent expeditions, such as those given in Mr. C. Clementi's 'Summary of Geographical Observations taken during a Journey from Kashgar to Kowloon, 1907–8' (printed by Noronba & Co., Hong Kong, 1911); Commandant Ch. Lemaire's report on the 'Mission Scientifique Congo-Nil, 1906' (Bruxelles: Publications des l'État Independent du Congo); and *Journal Suisse d'Horologerie*, No. 9, Mars 1912. Geneve: 2, Rue Necker). The two latter deal specially with the rates of the Guillaume balance watches, made by Ditisheim.

Some idea of what may perhaps be expected may be gained by comparing the figures in the table given below, taken from the number of the *Journal Suisse d'Horologerie* referred to.

Two Ditisheim Guillaume balance watches were taken on a recent Swiss expedition to the interior of Greenland, under M. de Quervain, and before starting the rate of each was carefully obtained; and on the supposition that these would remain the same throughout the journey, the differences between the two watches was worked out ahead for each day during which the journey was likely to last. But naturally this difference was not the actual difference found, and the variation between this computed difference and the actual difference found on the journey is given for each day in the following table:—

Date.	Différence entre les états obtenus par *extrapolation* et les états *réels*.	Date.	Différence entre les états obtenus par *extrapolation* et les états *réels*.
Juin 27.	− 0·4 en bateau et canot.	Juillet 18.	+ 2·0 Temp. + 5° á − 5° c.
28.	+ 0·0 ,,	19.	+ 1·4 ,,
29.	+ 0·1 ,,	20.	+ 2·0 ,,
30.	+ 1·1 ,,	21.	+ 2·3 ,,
Juillet 1.	+ 1·6 ,,	22.	+ 1·0 ,,
2.	+ 3·0 ,,	23.	+ 2·1 ,,
3.	+ 2·8 ,,	24.	pas de comparaison.
4.	+ 2·9 ,,	25.	+ 3·2
5.	+ 1·4 sous la tente.	26.	+ 3·7
6.	+ 1·8 traversée des rochers de la côte. Temp. + 5° á − 5° c.	27.	+ 3·5
		28.	+ 4·3
		29.	+ 4·2
7.	+ 0·4 en route dans l'inlandeis, altitudes 600/1700 m.	30.	pas de comparaison, en route 24 heures ininterrompues.
8.	− 0·2 ,,		
9.	− 0·8 ,,	Août 31.	+ 3·2
10.	− 1·3 ,,	1.	pas de comparaison, en route 24 heures ininterrompues.
11.	− 1·4 ,,		
12.	+ 0·3 ,,		
13.	+ 0·0 ,,	2.	+ 1·1
14.	+ 0·2 marche pendant en bas.	3.	+ 1·6
15.	+ 3·5	4.	+ 0·4
16.	+ 3·2	5.	+ 1·1
17.	+ 2·8 en route dans l'inlandeis, altitudes 600/1700 m.		

The second table is from Mr. Clementi's report referred to above, and shows the comparison of the errors of a Blockley half-chronometer watch (B), Odin pocket chronometer (O), and an ordinary split-second stop-watch (SW) during a section of his journey.

Reference No.	Date in 1907–1908.	Time of comparison (astronomical from B.).	Height of thermometer in degrees F.	Difference between B. & S.W. +) means −) S.W. faster) than slower) B.	Difference between O. & S.W. +) means −) S.W. faster) than slower) O.	Difference between B. & O. +) means −) B. faster) than slower) O.
		h. m.	°	m. s.	m. s.	m. s.
104	December 12	5 14	26·9	−13 26·0	−23 27·7	+10 1·7
105	,, 13	2 41	34·7	13 34·8	23 22·8	9 48·0
105	,, 13	5 20	24·1	13 38·2	23 11·5	9 33·3
106	,, 14	2 35	36·3	13 51·7	23 24·3	9 32·6
106	,, 14	5 31	29·5	13 50·7	23 25·0	9 34·3
107	,, 15	2 58	32·2	14 1·9	23 30·6	9 28·7
107	,, 15	5 26	24·7	14 11·0	23 18·8	9 7·8
108	,, 16	3 23	21·0	14 26·4	23 16·1	8 49·7
108	,, 16	5 44	15·3	14 17·9	23 9·6	8 51·7
109	,, 17	4 18	29·3	14 35·7	23 9·9	8 34·2
109	,, 17	20 14	26·9	14 43·8	23 7·9	8 24·1
109	,, 17	22 2	28·1	14 40·6	23 21·0	8 40·4
109	,, 18	2 38	26·0	14 43·7	23 23·3	8 39·6
109	,, 18	5 13	21·0	14 45·5	23 15·4	8 29·9
110	,, 19	2 48	36·4	15 3·6	23 21·8	8 18·2
110	,, 19	4 48	30·5	15 0·0	23 18·0	8 18·0
111	,, 20	2 28	34·0	15 11·2	23 4·0	7 52·8
111	,, 20	4 42	30·0	15 9·4	22 54·7	7 45·3
112	,, 21	2 20	37·0	15 26·6	23 0·7	7 34·1
112	,, 21	5 21	32·2	15 32·7	23 0·1	7 27·4
112	,, 22	3 1	35·0	15 43·7	23 27·1	7 43·4
112	,, 22	4 19	33·7	15 48·1	23 19·3	7 31·2
113	,, 23	4 49	35·4	15 57·3	23 19·0	7 21·7
113	,, 23	16 32	32·0	15 56·7	22 56·0	6 59·3
114	,, 24	2 58	42·0	16 3·8	22 52·3	6 48·5
114	,, 24	5 24	36·3	16 7·3	22 53·7	6 46·4
115	,, 25	2 51	39·9	16 15·2	22 57·8	6 42·6
115	,, 25	5 40	34·0	16 18·2	23 2·8	6 44·6
116	,, 26	3 3	42·3	16 28·4	23 5·4	6 37·0
116	,, 26	5 31	35·7	16 23·8	22 58·0	6 34·2
117	,, 27	2 46	41·1	16 36·7	23 8·9	6 28·2
117	,, 27	5 23	38·6	16 35·0	22 57·3	6 22·3
118	,, 28	2 58	43·0	16 43·2	23 18·6	6 35·4
118	,, 28	5 20	37·6	16 48·8	23 1·2	6 12·4
119	,, 28	21 1	44·0	16 53·9	23 12·0	6 18·1
119	,, 31	10 25	37·0	17 25·1	23 35·1	6 10·0
119	,, 31	12 6	35·6	17 19·3	23 36·0	6 16·7

For actually recording the times of star or sun observations, in ordinary work, the split-second stop-watch has been found useful, and sufficiently exact if it is compared with the chronometer immediately before and after the taking of the observations; but when extreme accuracy is required an electrical chronograph is desirable. Mr. Agar Baugh (of Hatton Garden) has a new portable tape chronograph, designed by M. Ditisheim, by which time records can be obtained to within $\frac{1}{100}$ of a second.

This consists of a tape wound off a drum in the ordinary way by clockwork, and a marking pen connected by electrical wires with a watch. At each half-second a contact is made by a very fine spring adjustment, fitted to the second.

hand centre of the watch; a pen marks a line on the tape as it passes over the drum, about half an inch long, so that each second on the tape is represented by about an inch in length, one half of which is a line and the other half a blank space. A break is made at every 60th second, to mark the minutes. When it is desired to record an observation, all that is necessary is that the observer should press a pneumatic ball, and another pen instantly makes a mark on the paper tape by the side of the half-second mark made by the watch electric contact, and a comparison of the two gives the time of the observation with great accuracy. This chronograph weighs about 18 lbs., and can be carried without difficulty. The whole cost, including the watch, is £50.

The Night-Marching Watch.

I have frequently been asked by travellers if some simple arrangement could be designed in order to make use of an ordinary watch for marching by stars at night, so that in places and conditions where the magnetic compass cannot be used, and a man has only a watch with him, he could find his way about, without any additional instrument, provided he knows the names of a few of the principal stars, and can see them. In many parts of the world the Pole Star is useless for marching by, for even in suitable latitudes, owing to its not being so bright as many other stars, it is often obscured when brighter stars can be seen; besides, it is frequently in an unsuitable position for the line of march. In very low latitudes, and in all places south of the Equator, it is, of course, of no use.

Some months ago, therefore, I turned my attention to the subject of a night-marching watch, and desire now to describe the outcome of my efforts in this direction.

Fig. 8 shows the arrangement, and from this it will be seen that it is an ordinary twelve-hours watch. The rim that carries the glass has fixed to it a circular disc upon which are given in concentric circles, the dates, and the names of about a dozen of the principal stars whose declinations do not exceed 30° N. and S. These have been selected so that some of them should be visible in all latitudes at any time of the year. Each star is placed approximately under the date when it will be on the meridian at twelve o'clock, or local mean noon. This circular disc bearing the dates and star names can, with the rim, be rotated so that any date can be placed opposite the hour of XII. The glass of the watch can be rotated independently of the rim, and bears a luminous mark B made of radium paint which can be readily seen in the dark; luminous radium paint marks, of different shapes, are also carried by the rim and the hour-hand of the watch. That on the rim is marked A, and that carried by the hour-hand, C, on the diagram. Since the Earth turns on its axis once in twenty-four hours and the hour-hand passes round the watch-face approximately twice in the same time, when the day of the month is set to the hour of XII., the time shown on the dial at the position of any star is, with sufficient accuracy for the present purpose, half the local mean time of that star's meridian passage, reckoning from noon through twenty-four hours to the next noon. Therefore, when using the watch for night marching the day of the month is first set opposite the hour of XII., and the luminous mark A on the rim is set to double the time shown on the dial opposite the star selected. The luminous point B on the glass is then moved to any convenient position to the *right* of the mark A if the star has not reached the meridian, and to the *left* of A if it has already passed the meridian. The watch is now held with the luminous mark A furthest away, and raised at an angle roughly equal to the

co-latitude of the place (within a few degrees is near enough). With the mark B on the glass nearest the eye, it is then turned round horizontally, still keeping it roughly at the co-latitude until the marks B and C are in line, and in such a position that a line perpendicular with the watch-face over the luminous point C carried by the hour-hand is in the direction of the star. When this is done the true south point will be shown by the luminous mark A. This holds good for all places where the star crosses the meridian to the south of the zenith, but when it crosses to the north, instead of placing the luminous marks B and C in line with the star, B is placed near the eye and the point A towards the star, in which case C will indicate the true north point of the horizon. Any other direction may be set on the watch instead of the N. and S. points, if desired, by

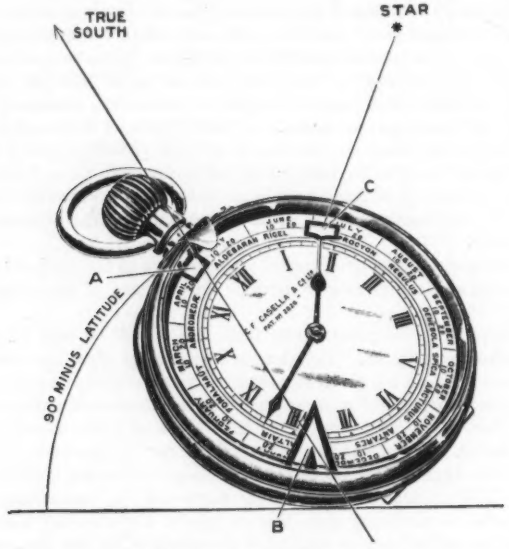


FIG. 8.—NIGHT-MARCHING WATCH.

counting one hour as 15° and setting the luminous point A on the rim to this position.

Owing to the fact that the heavens make one turn in twenty-four hours while the hour-hand of a watch passes round the dial twice in about the same time, three hours, or 90°, on the watch dial represent six hours in the heavens, so that one hour on the watch equals two hours in the heavens. This means that we cannot use the graduations of a watch dial as a compass without halving the angles. But since the angle at the centre of a circle is double that at the circumference standing on the same arc (Euc. III. 20), if we take the sighting point back on to the circumference we *do* halve the angle, and thus the necessary division into two is made, and the end of the hour-hand will, with sufficient accuracy, follow the star's movement if viewed from this point on the circumference.

Again, since all angles in the same segment of a circle are equal to one another

(Euc. III. 21), this luminous sighting point B need not occupy any special position provided it is placed on the proper side of the dial, but can be put just where most suitable to the right or left of the time of meridian passage mark. There are several advantages in making use of these geometrical theorems; first of all not having to place this sighting mark to any particular point greatly simplifies the setting, and in the second, carrying the line across to the opposite side of the watch dial gives it a much greater length, and thus considerably increases the accuracy of sighting for marching purposes.

When the watch is carefully held and sighted, and the centres of the luminous points are taken, the accuracy possible is certainly equal to that of an ordinary pocket compass; but it possesses several advantages over that little instrument, even in its most approved form. In the first place, since the bearings are from the true north and south points and not the magnetic, they are, of course, not liable to error through local attraction, and there is no "variation" to trouble about. The watch can also be used for marching by the sun if desired, and it will be seen that it is, in a sense, a development of the familiar method of marching by a watch by pointing the hour-hand at the sun, and then reckoning the point midway between the hour of XII. and the hour-hand to be the south point. As regards holding the watch at an angle equal to the co-latitude, a very rough approximation is quite near enough for the purpose, as an error of 10° or so in this angle is not likely to cause more than an error of 2°–3° in the bearing, and frequently not even this. In high latitudes, if stars that cross the meridian at a low altitude are selected, it is quite near enough to hold the watch horizontal when using it for marching purposes. It is preferable always to use stars for marching that pass the meridian at a fairly low altitude. Radium paint used for illuminating the points has the advantage over ordinary luminous paint in that it is not necessary to expose the watch to daylight before using it at night. (The Night-Marching Watch is made by Casella & Co., and can be obtained for £2 15*s.* to £5 15*s.*, according to the quality.)

Where there is any difficulty in knowing the local mean time for starting the watch it can be found without computation near enough by means of the astronomical compass (made by Stanford).

The *Astronomical Compass* was described fully in the *Geographical Journal* for December, 1908, so that it is hardly necessary that I should attempt to give details of it again. However, I should just like to state that, in addition to being found useful for finding local time, it has proved to be most serviceable for obtaining a rough value of the variation of the compass when no regular astronomical observations could be taken for the purpose. Its readings of bearings are quite as accurate as those taken with a prismatic compass, and time can be determined with it within about one or two minutes. During the four years since the astronomical compass first appeared, it has been used by travellers in many parts of the world, and I am constantly hearing of the service it has been in wild, out-of-the-way places. The Society has lately received a route map of a recent journey through East Africa upon which the variation of compass and approximate time were found by one of these instruments, and the resulting route traverse, when checked afterwards on to positions determined by astronomical observations, was found to be remarkably correct. In the *Geographica Journal* for December last, a traveller in north-west Mexico writes of the value the little instrument was to him in those regions where, owing to local attraction, the ordinary magnetic compass was quite useless.

It is hardly necessary to state that neither this astronomical compass nor the night marching watch which I have just described is intended for anything

like accurate mapping; but for hasty route traverses and marching they will, I feel sure, be increasingly useful.

Astrolabe à Prisme.

Reference was made earlier in this paper to a French instrument called the *Astrolabe à Prisme*, introduced by Messrs. Claude and Driencourt, which is coming into use in determining the latitude and local time in connection with more exact geodetic work. There is more than one form of this instrument, but that constructed by M. Jobin, of Paris, seems to be most generally used.

The instrument consists, in the main, of a telescope in front of which is fixed a prism, with the faces cut at an angle of 60°, and a mercurial artificial horizon placed below the prism, so that rays of light passing from a star are reflected from the mercury on the lower face of the prism, and thence down the

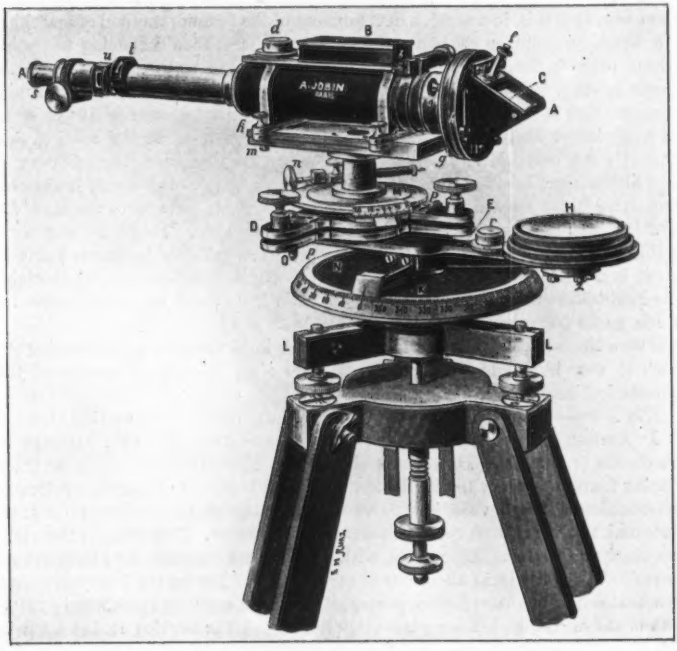


FIG. 9.—ASTROLABE À PRISME.

telescope to the eye, while other rays from the same star fall directly on to the upper surface of the prism, and, like the former, pass down the telescope to the eye. Thus, when the star attains an altitude of exactly 60° its two images are seen to coincide, and when this takes place the time is noted. This will be clear from Fig. 9, which is from a block kindly lent by M. Jobin, who has been also good enough to lend the instrument for exhibition. Equal altitude observations of a number of stars, at least three, on different sides of the horizon,

are taken, and from these the latitude and local time at any instant during the observations are computed. The azimuth can also be obtained if required.

The following are the various parts of the instrument, as indicated by the letters on Fig. 9:—

AA Astronomical telescope with a prism of 60° in front of the object glass. C Prism of 60°. *s* Microscope eyepiece of A, which can be replaced by the sighting auto-collimator in operations for adjusting the prism. *t*, *u* Openings, with glass for protection, for illuminating the wires and diaphragm. *d* Level for levelling the telescope, adjustable by three screws. B Magnetic compass needle. *b* Screw with locking nut, to permit of the turning of the prism round the axis of the telescope. *k*, *k* Milled-headed screws in the collar of the telescope by which the telescope can be fastened to and taken off its base plate. *m* Screw for adjusting the axis of the telescope perpendicularly to the axis of rotation. *g*, *h*, *x*, *f* Screws by which the prism is fixed to the telescope, and for

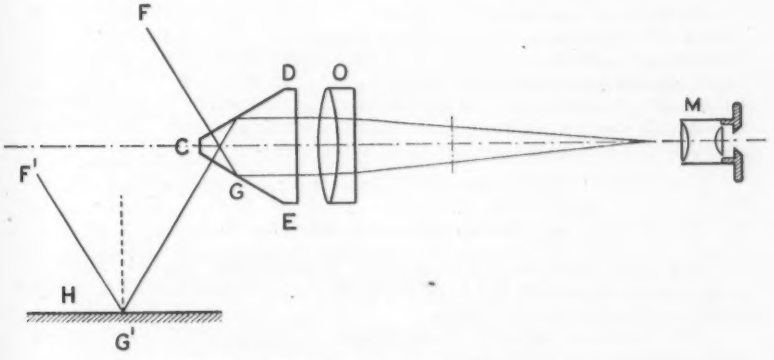


FIG. 10.—PRINCIPLE OF ASTROLABE À PRISME.

its adjustment. *a* Axis of rotation of the telescope alone. *n* Clamp and tangent screw for giving a slow motion of the telescope round the axis *a*. M Graduated sector of a circle. D Tripod with screws. *p*, *p* Key by which the tripod plate D is fixed to the under plate E. O One of two spring pins for locking *p*, *p*. E Bronze support carrying on one end the telescope and its fittings, and on the other the mercurial horizon H. K Axis of rotation of E, and consequently of the whole apparatus. *r* Adjustable level by which E can be levelled. H Mercurial horizon; its exact position upon E is assured by a conical fitting. Z One of three double screws for adjusting the conical axis of H parallel with K. N Graduated circle furnished with clamp screw for clamping on to K. L Three levelling foot screws upon which the instrument stands on its wooden tripod.

Fig. 10, taken from Claude and Driencourt's book, shows the principle of this instrument, and by referring to this, and the brief description of the various parts of the instrument just given, its construction will be understood.

One of the advantages claimed for this instrument is that special accuracy is secured, owing to the fact that there are no graduation errors, or errors caused through mistakes in reading angles off the circles; and of course, the altitudes being the same, and the observations taken on different sides of the horizon,

errors due to uncertainty of refraction would be eliminated, as should be, indeed, any constant error that affects all the observations alike. (For a complete account of the *astrolate à prisme*, see Messrs. Claude and Driencourt's work, published by Gautier, Paris.) Prices: £190 large size to £50 small size.

CDE	Prism of 60°.
O	Object glass of telescope.
M	Eyepiece of telescope.
H	Mercurial artificial horizon.
FG	Ray of light from star falling on upper surface of prism and thence down the telescope to eye.
F′ G′	Ray of light parallel with FG, falling on to artificial horizon H, thence on to lower face of prism, and so down the telescope.

The instrument is most ingenious and accurate, but it would be interesting to see a comparison of results of observations taken with it and a good transit theodolite with the circle set at the same altitude, 60°, and kept at this angle.

Some idea of the relative value of observations taken with the two instruments can perhaps be obtained from particulars that have already been published. For instance, the *Monthly Notices of the Royal Astronomical Society*, vol. **63**, No. 3, January, 1903, gives, in a paper by Mr. W. E. Cooke, M.A., of Western Australia, the results of determinations of latitude from different stars, by an equal-altitude method, in which an ordinary 5-inch theodolite was used (p. 157). The latitudes resulting from these equal-altitude observations were—

1902	°	′	″
December 17	31	57	10·9
,, 18	31	57	9·6

Mr. Cooke states the real value of the latitude of the station is unknown to a fraction of a second, but is, as nearly as he could obtain it, almost exactly midway between these two values.

The individual latitudes obtained with the 5-inch transit theodolite on December 18, were as follows:—

°	′	″
31	57	10·4
31	57	9·0
31	57	10·6
31	57	8·4

On p. 161 there is another set taken in a similar manner with a 12-inch theodolite, with the following results:—

°	′	″
31	57	10·3
31	57	10·1
31	57	10·5
31	57	10·2
31	57	10·2

Working on much the same lines, although differing in details and method of computation, Mr. E. B. H. Wade, M.A., on his surveys in Egypt, fixed the latitude of a station near Luxor, by equal altitudes, with an 8-inch theodolite as follows:—

°	′	″
25	44	12·0
25	44	10·4
25	44	11·0

For the sake of comparison with these theodolite latitudes the following latitudes taken with an astrolabe à prisme are given. They are the results of observations for the latitude of the Pic du Midi, taken at the same time as the wireless determination of longitude, referred to elsewhere, and are as follows :—

°	′	″
42	56	30·0
42	56	31·1
42	56	31·2
42	56	30·8
42	56	30·6

It is interesting to note, in passing, that the weighted mean of these latitudes is 18·7″ greater than the latitude given in the *Connaissance des Temps* from Colonel Puissant's *Description Géométrique de la France*, 1832; but the difference is attributed to local attraction of the plumb-line.

The theodolite results as compared with those obtained with the astrolabe à prisme are certainly worthy of attention, notwithstanding the differences in methods of computation. As regards observation, those taken with the theodolite are all equal altitudes of different stars taken at various azimuths. The astrolabe à prisme is a special instrument constructed for measuring altitudes of 60°, and can be used for no other purpose, while, of course, the theodolite can be used for this and for other observations as well. The question is whether the accuracy obtained with the astrolabe à prisme cannot also be obtained with a good theodolite set at a suitable angle, and kept at that angle throughout the whole of the observations.

The 12-inch theodolite results shown above are more in agreement with one another than those taken with the astrolabe à prisme; but perhaps it is hardly fair to compare the results of these two instruments. If the 8-inch theodolite readings are considered it will be seen that the greatest difference between any of the three readings is 1·6″, while the greatest difference between the five latitudes obtained by the astrolabe à prisme 1·2″.

The four 5-inch theodolite latitudes shows 2·2″ as the extrême difference; but in observing these no special pains were taken to obtain the best results, and the adjustments were not attended to beforehand. Referring to these observations, Mr. Cooke states that he used a candle lamp, and an ordinary watch; he had in his theodolite one vertical wire and one horizontal wire, and there was no assistant. The watch did not tick either seconds, half-seconds, or any particular fraction of a second, and he had to get the time as best he could. Now, if such results could be obtained under these circumstances, it is reasonable to suppose that under more favourable conditions the results would have been but little if at all inferior to those taken with the astrolabe à prisme. However, perhaps it is too early yet to decide this point finally; the figures given are interesting so far as they go, but before the relative values of the two instruments can be settled further comparisons must be made; and it would be necessary to have observations taken under exactly similar conditions and computed by the same formula. It is certain that the astrolabe is an excellent instrument for its purpose; it is giving great satisfaction, and is now being used on recent geodetic work and astronomical observations on French boundary expeditions.

(To be continued.)

REVIEWS.

EUROPE.

Irish Tumuli.

'New Grange (Bragh Na Boinne).' By George Coffey. Dublin: Hodges, Figgis & Co. 1912. *Illustrations.* 6*s. net.*

There is nothing new, which has geographical bearing, in this last booklet of the veteran Keeper of Irish Antiquities. Though it has for sub-title "The influence of Crete and the Ægean in the Extreme West of Europe in Early Times," what is said on this theme occupies little more than one short chapter, and does not amount to more than endorsement of the well-known theory that the spiraliform ornament, which originated in the Ægean bronze age, reached Ireland *viâ* the Baltic amber route and Scandinavia. It is interesting to find Mr. Coffey's authority thrown on the side of the party which uses archæology to emphasize Ireland's cultural independence of Great Britain; but it is not convincing, simply because no new evidence is adduced to prove or disprove the passage by one way or the other. It is quite likely that the Scandinavian theory is right, but if it is ever to be certain it must rest on more than spiraliform ornament; for this has demonstrably developed independently in more than one area of the world. There is, as a matter of fact, other evidence pointing to an ultimate south-east European influence on Irish art; but the scope of Mr. Coffey's book does not admit it.

'Rome.' By H. T. Inman. (London: Stanford. 1912. Pp. xii., 297. *Plans.* 4*s.*) A guide to Rome, "the cradle of Western civilization, as illustrated by existing monuments," cast in narrative form, but systematically arranged and convenient for reference. This is a practical book of convenient size, in which nothing is attempted in the way of adornment.

'Murray's Handbook for Ireland.' (London: Stanford. 1912. Pp. [65], 604. *Maps.* 9*s.*) It is well that these favourite guides should be maintained up to date, and in this instance the editor, Mr. John Cooke, has evidently applied a careful revision, though the table of routes to Ireland enters, perhaps, too far into details in view of their liability to change. The admirable series of Mr. Bartholomew's maps is one of the chief recommendations of this guide.

'The Romanization of Roman Britain.' By Prof. F. Haverfield. (Oxford: Clarendon Press. 1912. Pp. 70. *Maps and Illustrations.* 3*s.* 6*d.*) This second edition has been greatly expanded from the original paper presented to the British Academy. We find in the first chapter, on the Romanization of the Empire, a few suggestive sentences on the geographical factors involved in its extension.

'The Place-names of Oxfordshire.' By H. A. Alexander. (Pp. 251.) 'Warwickshire Place-names.' By W. H. Duignan. (Pp. 130.) (London: Frowde. 1912. 5*s. each.*) These two volumes successfully carry on the good work of elucidating the philology of English place-names. In a preface to the first, Prof. H. C. Wyld outlines the present condition of that department of research generally, and shows what a wide field is still open. The matter is one of profound interest to geographers, for, the philological lines once laid down, there is much research on geographical lines which might be based upon it. Both volumes are conveniently arranged with place-names in alphabetical order, and contain appendices

of the chief proper names or terms which form component parts of the place-names.

'Wanderings on the Italian Riviera.' By F. Lees. (London: Pitman. 1912. Pp. xv., 350. *Maps and Illustrations.* 7*s.* 6*d.*) This writer's "wanderings" have led him into many sequestered districts where few foreign visitors go, especially when he leaves the Riviera itself and works his way into the upland valleys. This is a book, therefore, for readers who are willing to quit the regular tourist lines; any who do so will clearly find ample reward in these remoter parts of Liguria. The author's Italian companion, by his wide knowledge of the locality, has played the part of a most efficient collaborator.

ASIA.

Mecca and Sana'a

'A Modern Pilgrim in Mecca and a Siege in Sana'a.' By A. J. B. Wavell. London: Constable & Co. 1912. *Illustrated.* 10*s.* 6*d. net.*

By a combination of adroitness, pluck, and good fortune Mr. Wavell has added his name to the not over-lengthy list, which began with Varthema in the opening of the sixteenth century and ended with Gervais-Courtellemont late in the nineteenth—that is, the list of Europeans who have visited both the holy cities of Islam and returned to tell their tales. He went to those forbidden places four years ago, apparently professing Islam with all sincerity, but in an assumed character, the better to escape official hindrance at the outset, suspicion further on, and the certainty of inconvenient questioning all the time. Whether his precaution was worth the grave risk which it entailed may be doubted. Disguise, like an *alibi*, is the worst of all defences if not sustained. Mr. Wavell had some bad moments, and was forced more than once to sink one assumed character and take on another; but on the whole his path was made fairly easy. Conversant with Moslem practice and with Arabic, possessed of facial advantages for making up as a young *effendi* of quality, screened by two faithful attendants privy to his secret, he had no serious solicitude except to avoid any who might have known him in an earlier state of existence in British East Africa. This, with some "close calls" and the help of luck, he succeeded in doing. His task was facilitated by the newly opened Hejaz railway, which took him from Damascus to Medina, and to some extent by the disturbed state of the environs of the latter town; for its inhabitants had for the moment something more to do than to pay attention to their visitors. Since the line goes no farther, Mr. Wavell had to proceed by caravan to Yambo, thence by steamer to Jidda, and, as usual, by donkey up to Mecca. Why he went at all he never explicitly states; but it is reasonable to suppose that his motive was love of adventure, added to a genuine desire to gain the credit and style of a *hajji*, which, apart from other considerations, would be helpful in future journeys on Moslem soil. In fact, Mr. Wavell had much the same motives as Burton, with less pretence. Like other European pilgrims, he found the Meccans easy enough to deal with, and the ceremonies of the actual pilgrimage no worse than fatiguing. Danger there was in the excursion to Arafat, as on the ride down to Yambo; but our pilgrim was too well equipped to suffer anything more grave than a loss of money and other effects at the hands of a sneaking night thief.

In this journey Mr. Wavell did not profess, and could not expect, to serve science. But when two years later he went to Yemen, it was distinctly with a view to geographical exploration, and he carried the necessary equipment. But

fate was as much against him here as it had been for him at Hejaz. He ventured to Hodeidah in his own proper character, avowing his genuine intentions. The Turks promptly concluded—of course they did!—that, whatever his real intentions might be, they were not at any rate what he was pleased to profess. The moment was unfavourable. Chronic disorder was gathering into a general rising against the Ottoman occupying force. Mr. Wavell's arrival was believed to be not unconnected with this coming outbreak. He was treated as a spy, dogged, and reported on. Weary of asking to be allowed to go up country, he took French leave at last and rode into Sana'a, having forestalled the news of his departure by an hour or so. Hardly was he there before the Imam's hordes appeared and laid siege to the place. He remained till a force sent from Constantinople effected the relief, and then found that, after all his waiting, he was to be sent back, not forward. He got out of Sana'a by a ruse, but through the bad faith of an accomplice was captured and put under closer guard than ever. Finally he was sent back to Hodeidah.

On his misadventures at Sana'a Mr. Wavell based a serious complaint to the Foreign Office, and a claim for compensation, and he puts his case before his readers. It will perhaps seem less strong to every one else than to himself. He played with much courage, astuteness, and science a game of bluff—or, perhaps, rather of hide-and-seek—with the local Ottoman authorities, and lost it after a very fair run for his money. There, we venture to think, he had better have left the matter. If, strictly speaking, owing to the anomalous position of Europeans in Turkey, his rights under treaty were infringed by the refusal of the authorities to let him go wherever he pleased in Yemen, it was hardly reasonable to insist on those rights in Arabian Turkey; and he might reflect that no other Power, if it had been occupying Yemen at that moment and in that state, would have allowed him to go about the country at his own sweet will. If he wishes to get to Marib and beyond, he must not expect the Turks to further him with their blessing until their position in Yemen is vastly better than he himself has painted it.

Mr. Wavell does not profess to set forth geographical matter in this book. Nor had he much opportunity of adding to our knowledge. A pilgrim following the well-worn Mecca tracks, and bound to keep himself to himself, cannot hope to tell us as much as Snouck-Hurgronje and others have told us already. But it is interesting and not without scientific importance to get a fresh first-hand account of Medina and Mecca at the present day, as well as of Sana'a and the Hodeidah road. Mr. Wavell's is the best description of the capital of Yemen since Manzoni's, and the juncture at which he visited the place enabled him to learn a good deal about the political condition of South-Western Arabia in general. We should like to have heard more, even at hearsay, about the Imam's country and the communications with Mecca, and perhaps some day Mr. Wavell may tell us this. His courage and his qualifications are so singular that it will be more than a pity if he is not encouraged to revisit Arabia.

D. G. H.

The Indian North-East Frontier.

'In Abor Jungles; being an account of the Abor Expedition, the Mishmi Expedition, and the Miri Mission.' By Angus Hamilton. London: Eveleigh Nash. 1912. *Maps and Illustrations. Price* 18*s. net.*

Mr. Angus Hamilton, who has lately been very busy between Bulgarians and Turks, has written a most useful account of the late little frontier campaign against the Abors which was carried through successfully, without a single

contretemps which could rank as a disaster, by Sir Hamilton Bower. It is very seldom that these little frontier wars, which necessarily entail the employment of several columns of troops acting more or less independently, are brought to a conclusion without any episode of a disagreeable character calling attention to their existence in the public press. When no such episode occurs the ignorance and apathy of the public mind with regard to them remains undisturbed. No such episode occurred under General Bower's able management, or that of his equally able staff—consequently, the public knows little and cares little about the Abor expedition. Mr. Hamilton's book, then, is a sort of revelation to those whose interest in the subject could only be kept alive by stray little paragraphs in the newspapers from time to time, and its usefulness is all the greater that, added to a vivid and picturesque account of the north-east frontier tribes generally, of their manners and habits, and of the unpleasantly fascinating jungles in which they live, there is a short epitome of all previous missions which have taken place on this part of India's frontier within the last century. The action of the three columns which formed the expeditionary force against the Abors under General Bower is followed out in most lively detail, and we now hear something, for the first time, of two other almost simultaneous expeditions which were pushed into the Mishmi and the Miri countries respectively for definite political purposes. The Mishmi expedition under Mr. Dundas was for the purpose of finding out the exact extension of Chinese occupation in advance of Rima along the Lohit Brahmaputra. The Miri mission was carried out under arrangements made by the Assam Civil Government for the apparent purpose of effecting a peaceful promenade amongst the friendly Miris. But it was found that the Miris were anything but friendly, and the oft-repeated blunder having been committed of placing the mission under Civil Control, there was as near a disaster in the heart of the Miri hills as any soldier would care to risk. In fact, but for the gallantry of Captain Graham who commanded the escort, and who on extremely short notice (he was roused out of bed) shot down ten armed tribesmen who formed part of a gang bent on raiding the camp, that camp would certainly have been annihilated.

To appreciate the awful difficulties of a campaign in jungles such as those of the North-East Himalayan foothills, infected with poisonous insects, "80 per cent. of which stung and 20 per cent. stank," and beset with myriads of ingenious devices for the sudden destruction of the unwary invader, one should read Mr. Hamilton's fascinating description of them. "Little wonder," he says, "that the Abors regard these haunts as inviolable, for dark, mysterious, and rising like some evil enchantment before the traveller, the forest presents an impregnable rampart of trees and undergrowth, impassably entangled." "There was, too, not a little mystery in the almost total stillness and the dim half-lights of the dark glades. From their moist recesses Nature defied herself, for, while every form of tropical growth preyed upon its neighbour, one and all combined to suspend the curtain of their entanglements before the sun." It was in the twilight of jungles such as these, and under a canopy of perpetual and torrential rain, that the columns moved slowly to the appointed end. There was no lack of fighting before that end was attained, and some of the best stories in the book are those which tell of the splendid courage of the attack and the occasional desperation of Abor defence. There are numbers of most excellent photographs in the book, from which it is easy to gather that these children of the mists and the forests are no children when it comes to hard blows. Mr. Hamilton's book should be a text-book for frontier students. The geographical results of the expedition have yet to be fully worked out.

T. H. H.

Researches in Northern China.

'Through Shên-Kan.' By Robert Sterling Clark and Arthur de C. Sowerby. London: T. Fisher Unwin. 1912. *Map and Illustrations. Price 25s. net.*

The volume which tells of the expedition, planned and organized in 1908 by Mr. R. S. Clark, of New York, for the exploration of the north-western provinces of China contains within its cover more information on widely different subjects than is generally to be met with in books of travel. In addition to the story of the journey, there are a route map reduced from a survey on the scale of 4 miles to the inch, a list of astronomical observations for latitude and longitude of all towns visited, a number of excellent photographs and coloured plates, and some extremely interesting studies of the zoology and geology of North China by the authors of the book. Papers by the Hon. N. Ch. Rothschild and Mr. H. R. Hogg on some new species of fleas and spiders found in the journey close the volume. There is, therefore, no lack of valuable material in the book. Nor is there lack of interest; the story is well told, and much of the journey was over new ground. But it is hardly possible to close the book without a sigh of regret that such careful organization and such capable men were not able to accomplish more. The explanation lies in the murder of Hazrat Ali, the invaluable surveyor lent by the Survey of India, and in the consequent recall of the expedition when less than half its programme had been carried out.

The expedition consisted of Mr. Clark, Captain H. E. M. Douglas, V.C., R.A.M.C. (who had been lent by the Government of India as doctor and meteorologist), Mr. H. B. Cobb (artist), Mr. G. A. Grant (interpreter and general manager), Mr. A. de C. Sowerby (naturalist), and Hazrat Ali (surveyor). After several months of preparation, the expedition started from Tai Yuan Fu, in Shansi, which had been selected as the base, and, crossing the Fên river, proceeded up the course of a western tributary to the divide between the waters of the Fên and Yellow rivers. From this point an excursion was made to the Mo Erh Shan, 9296 feet, a mountain not shown as such on Chinese maps. From it a view was obtained extending nearly 100 miles in every direction, thus recalling a somewhat similar view which Richthofen gained of the great loess country from the Shan on the east side of the Fên river. It is noteworthy that in the sketch-map a range of mountains to the north-east, marked as the Yün-ting Shan, appears to occupy the position of Richthofen's Yün-tshung Shan, which he supposed to be a continuation of the Ngo Shan. In his very interesting notes, in chapter xiii., on the geology of the country traversed, Mr. Sowerby places Mo-erh Shan in a range of igneous and metamorphic rock, the Chiao-ch'êng Shan, extending from Ming-wu Fu to Yung-ning Chou, which he himself has penetrated at five different points. The existence of this range, which constitutes the divide between the waters of the Fên and Yellow rivers, is of great interest, for, as Mr. Sowerby points out (p. 117), Richthofen seems to have had no suspicion of its presence. At the same time Richthofen, according to Mr. Sowerby, is not altogether wrong in describing the country west of the Fên river as a plateau of horizontal coal-bearing strata. "There are," he says, "undoubtedly great stretches of country marked by beds of this nature; but on the other hand there are large areas where, but for the loess, the Sinian limestone would form the surface. I have found this to be the case in the mountains west of Kê-lan Chou . . . and again at Wu-ch'êng. It also forms certain high peaks situated physiographically between the Shansi formation and the pre-Cambrian rocks in the Ning-wu district. Of course the outcrops of pre-Cambrian (igneous and metamorphic) rock, already referred to, form a large area."

From Mo-erh Shan the expedition continued its route over high ground towards the Yellow river, passing on the way the Ching Ting Shan, a mountain mass extending over not more than 25 square miles, which throws up three great granite peaks high above the surrounding loess country. The Yellow river was crossed without mishap at Huang-ho Yeh. Still continuing westwards, over ground which has not been previously described, the expedition reached Yü-lin Fu, and thus saw something of the Ordes country. At Yü-lin the party stopped for a month before travelling southwards across the numerous rivers and ravines which lie on the west bank of the Yellow river. At Fu-chou they struck off across the mountains *viâ* Ching-yang Fu to Lan-chou Fu, crossing a loess pass of 7600 feet near Chü-yuan, and keeping the snowy peaks of Liu-p'an Shan to the south. From Chü-yuan the road struck south to Ching-ning Chou, through a country differing from other parts of Shensi and Kansu in the rich red earth of the valleys.

At Lan-chou Fu, this party was rejoined by their friends who had taken the well-known route *viâ* Hsi-an Fu and Ping-liang Fu. A short distance to the south of Lan-chou an attack was made on Hazrat Ali, while surveying without arms or an escort. The details never became known, and all search for him was in vain. At last, yielding to advice from Peking, the party turned home, Messrs. Sowerby and Grant returning by the route by Chü-yuan to Fu Chou and Sui-te to Tai-yuan, while the others travelled by Hsi-an Fu and Honan to the coast. The Chü-yuan route, seen in the height of summer, presented a very different aspect from that displayed in March. Mr. Sowerby was especially struck by the beauty of the country east of Ching-yang Fu. His picture of it gives a very different representation of loess lands from that with which one is familiar. Near Yen-an Fu the tablelands furnish another variety from the ordinary type of loess, due, it seems, in part to the desolation which followed on the famines of 1877–79, and to the absence of cultivation since that date. This has encouraged the growth of trees and wild herbage, which now gives cover to deer, pheasants, and other game. Mr. Sowerby draws a distinction between "loess" and *shao-t'u* (baking-earth), which contains a certain proportion of clay and is used for fuel, and while restricting the term "loess" to pure æolian deposit, includes both this and fluvial loess in *huang-t'u* (yellow earth), the name used by Chinese and adopted by Mr. Bailey Willis. His remarks on these formations (pp. 115 and 127) and the plate (56) showing loess in stratification are worthy of attention.

Frequent reference is made to the difference in Kan-su between the indolent Chinese opium-smokers of the province, the more manly and abstemious Mohammedan, and the vigorous immigrant from Sechuen, who seems to have the making of a fine colonist. The scientific chapters and the appendix are by no means the least valuable portion of the book, and give rise to the hope that at some early date the original programme of the authors may be carried out, for the country between Lan-chou and Cheng-tu in Sechuen must offer a magnificent field of exploration to the naturalist.

It is impossible to close without a reference to the magnificent piece of work which Mr. Sowerby carried out last winter, when he led a party from Tai-yuan to the rescue of the missionaries who were shut up in many of the far distant cities west of the Yellow river. The success which attended him may in part be due to the knowledge which he had obtained of the country in the journey described in the present volume.

W. R. C.

AFRICA.

French West-Africa and the Sahara.

'Through Timbuctu and across the Great Sahara.' By Captain A. H. W. Haywood, F.R.G.S., Royal Artillery, with forty-five illustrations and a map. London: Seeley, Service & Co. 1912. 16*s. net.*

Captain Haywood, then quartered at Freetown, having obtained six months' furlough, travelled, during 1910, from Sierra Leone to the source of the Niger, followed that river down past Bamako, Segu, and Mopti, visited Timbuktu, thence continuing down stream to Gao. From this point he struck across the Sahara by way of Adrar of the Iforas, the dreaded Tanezruft, and Tidikelt, to Wargla, ending his adventurous journey at Algiers. In the extremely interesting book before us Captain Haywood, the first Englishman for many years to traverse the Western Sahara, gives the chief results of his remarkable journey. Of exploration in the sense of visiting absolutely unknown country he has very little to record, but in the Saharan part of his journey he was able to fill in several details which help materially towards a complete knowledge of the great desert.

To many readers the first, and the larger part of the book, will prove fully as attractive as the description of the crossing of the desert. Captain Haywood has a keen, observant eye, and his interests are comprehensive. There are not only notes on land-formations, flora, and fauna—Captain Haywood is a keen and successful sportsman—but many shrewd comments on the peoples of the Niger Bend and on the results of French administration in West Africa. There are well-deserved compliments on the efforts both of French officials and of traders to develop the economic resources of the country, and it is noteworthy that the French non-official residents include not only merchants but several genuine colonists, enterprising men who are devoting themselves to cotton and rice-growing and to ostrich farming. The potential resources of the Niger Bend are very great; in the Macina province alone, of which Mopti is the capital, rice is already grown in large quantities, and with proper irrigation the output might be increased enormously. As usual in books of travel, information of this sort must be gathered in following the author's journey from point to point, but help is afforded to the seeker after knowledge by the index.

Well written and full of human interest Captain Haywood's book may be commended for its accurate picturing of a part of West Africa about which English folk know less than they should, considering the problems to be solved in their own possessions in that part of the continent. F. R. C.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Map Projections.

'Map Projections.' By Arthur R. Hinks, M.A., Chief Assistant, Cambridge Observatory, and University Lecturer in Surveying and Cartography. Cambridge University Press. *Price* 5*s.*

The subject of map projections has recently received a considerable amount of attention in this country, doubtless in great measure on account of the increased interest in geographical studies generally, and the higher scientific level to which they are being raised. Writers who have dealt with the matter in the past have, as a rule, been mathematicians who, after elaborate investigations, have arrived at conclusions, frequently expressed in lengthy formulæ, which the

ordinary man who has to construct maps fails to follow; or they have been those who have gone to the other extreme, and seeking to free the subject from supposed complications, have left out most of the mathematics, and produced a book which, though giving diagrams and more or less approximate rules, fail entirely to satisfy students desirous of following the subject intelligently.

The sort of book that was for a long time almost entirely wanting for the ordinary geographer and map draughtsman was a mean between these two. Mr. Hinks, who is well known as an astronomer, has now taken up the subject, and while he fully admits his indebtedness to Colonel Close and others, has produced a work of considerable interest, which should go a long way towards meeting this need, and one which possesses decided originality as regards some of its subject-matter and method of treatment. It consists altogether of 124 octavo pages, and is divided into the following chapters: 1, Introduction; 2, Principal Systems of Projections; 3, Cylindrical Projections; 4 and 5, Zenithal Projections; 6, Modified Conical and Conventional Projections; 7, Projections in Actual Use; 8, Simple Mathematics of Projections; 9, Numerical Errors of Projections; 10, Tables. The Introduction is specially good, and the explanations, both in this and other sections of the book, are illustrated by small diagrams that must be of great assistance in making matters clear to a beginner. The chapter entitled "The Simple Mathematics of Projections" is perhaps as simple as such a subject can be made to be at all complete; but it must be admitted that a fair amount of mathematics is necessary to follow the investigations here given. A specially interesting chapter is that on the Errors of Projections, in which, by means of a series of short tables, are set forth in figures the actual errors in azimuth, distance, and area, for maps of Europe, Asia, and Africa, as measured from the centre to the corners of the maps. Some six to nine different projections are dealt with in this manner, and the results are not only interesting, but will be of considerable value to those engaged in map drawing.

The tables in chapter x., although perhaps not sufficiently complete to meet the requirements of a professional geographical draughtsman, are useful, and well selected. Special tables are given for the construction of the international map of the world, on the scale of 1:1,000,000. There is an appendix, giving a short description of the Polyhedric, the Gauss Conformal, and the Retro-Azimuthal projections which were omitted from the earlier part of the book. As a coloured frontispiece is given Colonel Close's Transverse Mollweide's Equal Area Projection, showing the British Empire, for which purpose this projection is specially suitable.

E. A. R.

OCEANOGRAPHY.

The Atlantic.

'The Sub-Oceanic Physiography of the North Atlantic Ocean.' By Edward Hull, F.R.S. Pp. vii., 41. *With Eleven Plates.* London: E. Stanford. 1912. 21s. *net.*

'Geographie des Atlantischen Ozeans.' Von Prof. Dr. Gerhard Schott. Pp. xii., 330. Hamburg: C. Boysen. 1912.

In this splendidly-produced monograph Prof. Hull brings together the results (some of which have already been published) of his studies of soundings in the North Atlantic, and describes the submarine land features disclosed by the isobathic lines. Each section is treated separately as regards the general topographical features and submerged river-valleys, by a chapter in explanation of relevant plates; the valleys and cañons off the American coast are dealt with by Prof. J. W. W. Spencer, whose memoir on 'The Reconstruction of the

Antillean Continent" (published in 1895) first led Prof. Hull to undertake these investigations.

The most striking features brought out by the isobathic charts are the submarine continuations of the channels of such rivers as the Shannon, the Tagus, the Congo, and many others, to the edge of the continental platform, where they "descend through lofty walls of rock into the abyssal floor of the ocean." These clearly indicate the existence of a coast-line, now submerged, some 1000 to 1200 fathoms below the present surface of the sea, and afford conclusive evidence of the enormous vertical range of the movements of the Earth's crust.

Prof. Hull summarizes the conclusions to be drawn from a study of the maps under five heads. He finds (1) That in late Tertiary times there was a general uplift of the Atlantic ocean bed and adjoining lands to the extent of 6000 or 7000 feet or more, as compared with their present position, the sea-level being taken as the standard of measurement. (2) That this uprise extended from the Arctic ocean to beyond the centre of Africa, off Cape Verd, etc., as shown by the Congo submerged valley (in lat. 6° S.), and indeed to its southern extremity. (3) That such an uprise included the Mediterranean and bordering lands; the Alps, Apennines, and Central Europe. (4) That the effect of such elevation on the regions referred to would be to cause a general lowering of temperature; and a vast increase of snow and ice in the Alps, Pyrenees, Norway, and other mountain regions; as well as to develop snow-fields and glaciers in the British Isles and other lands, such as Mount Hermon, from which they are at present absent. (5) That at the close of the period of high elevation and intense Arctic cold, there was a general depression of the whole region accompanied by a rise in temperature; ultimately resulting, after several minor oscillations, in the climatic conditions of land and sea at present existing.

Controversial interest will probably centre round that part of Prof. Hull's discussion which proposes the deflection of the Gulf Stream, and more particularly its exclusion from the Gulf of Mexico, as a determining factor in the variations of climate resulting from the supposed elevations and depressions. The problem is known to be one of enormous difficulty, and it seems a pity that the work of modern oceanographers is not taken into account. Even if we admit the paramount importance to the Atlantic drift of that part of the waters of the equatorial current which now circulates round the Gulf of Mexico, we can scarcely suppose that under the widely different conditions induced by the existence of a broad strip of land connecting Europe with Greenland there would not be a vast difference in the discharge of the Labrador current, which is now known to exert a profound influence on the temperature of the Atlantic drift. The fundamental question, however, is: What were the nature and direction of the prevailing winds? The map (Plate IX.) suggests that the emergent plateau would in winter be occupied by a high pressure area continuous with those over Eurasia and Greenland; the "Iceland depression" would be shifted far to the south, and cyclonic systems denied access to the north and east. The north part of the Atlantic ocean would then be occupied by cyclones, probably of great number and ferocity, following tracks which it would not be easy to lay down, but producing prevailing easterly winds near the land. Thus the general drift of the atmosphere might be from the east and north-east, a type of weather now somewhat infrequent, but often remarkable for its persistence when it does occur.

Prof. Schott's book is a notable contribution to the list of works now happily lengthening, which are real geographical studies, inasmuch as they take a geographical unit as a whole and trace the influence of the geographical conditions, so far as they are known, upon all that lives and moves and has its being within

the area in question. We note with pleasure that Dr. Schott writes as an enthusiast with whom the glamour of the sea is always present, and as one who would agree with "Mr. McAndrew's" opinion of the youth who inquired if "steam kills romance at sea." After a chapter on the discovery and investigation of the North Atlantic—in which but scant justice is done, as we think, to some Swedish, British, and American investigators, and some well-known names are omitted altogether—Dr. Schott describes the form and structure of the Atlantic basin, its depths, its physical divisions, its climatic regions and fauna. In "applied" geography we have, besides an account of the great fisheries, an exceedingly interesting chapter on sailing and steamship routes, special features of trans-Atlantic trade, and the cable and "wireless" network. This last chapter we specially commend to teachers of geography. We should have welcomed a section on tides and tidal-streams, but apart from this omission Dr. Schott's book deals very adequately with his subject, and maps and illustrations are excellent and abundant.

H. N. D.

THE MONTHLY RECORD.

EUROPE.

Coast Erosion in Eastern Prussia.—A systematic study of present and past erosion of the coast of Samland, east of the Gulf of Danzig, has been lately inaugurated by Dr. R. Brückman, assisted by E. Ewers, and two papers describing the results so far obtained have been already issued ('Beobachtungen über Strandverschiebungen an der Küste des Samlands,' I. and II. Leipzig: Teubner, 1911–12). The first deals with observations at Gross Dirschkeim, Marscheiten, and Kreislachen, on the westward-facing portion of the coast, which is generally high and abrupt, though broken here and there by gullies. The erosive forces actually in operation are described in detail, including wind, frost, running and percolating water, and the attack of the sea waves. The different manner in which these act on different geological formations is also entered into. Thus, while wind erosion is most effective in the case of the micaceous sand known as that of Dirschkeim, frost is specially powerful in that of the conglomerate known as "Geschiebemergel." The various effects of erosion are well brought out by a series of photographs, particularly striking being one showing the newly-formed channels in the cliff talus resulting from twenty-five hours' heavy rain. An interesting point touched on is the fate of the large erratic block (40 feet in circumference), known locally as the Teufelstein, which thirty years ago occupied a position at the top of the cliff, 20 to 30 yards from its edge, where it was used by children at play as the winning point in their races. In the spring of 1907 it was precipitated down the cliff face, giving rise to a well-marked gully, and it now lies 15 yards out from the foot of the cliff, partly buried in the sand. There is evidence that it not only sinks deeper into this, but that it actually shifts its position, showing that such blocks must not be used as fixed points in estimating movements of the coast. By a careful survey of the actual coast-line and a comparison with earlier maps, the authors have attempted an estimate of the amount of annual loss on two different stretches of the coast, which works out as 0·37 and 0·5 metre respectively. The second paper deals with the most prominent angle of the coast—Brüsterort (meaning the breast-like point). In the absence of strictly accurate mapping, this has hitherto been regarded as forming an angular point, but Dr.

Brückmann found that it was really rounded like other projections of the coast. A constantly changing sandbank stretches out into the sea from its foot. The erosion of this spot is of practical importance by reason of the lighthouse built at the top of the cliff in the eighteenth century, the safety of which, it is feared, may eventually be threatened. A comparison of the present state of things with that shown on the plans drawn up in connection with the building of the lighthouse indicates a loss, within the last seventy years, of 8 metres on the west coast and 6·5 metres on the north. Dr. Brückmann's own survey will facilitate more precise estimates in the future.

Early Cartography of Tirol.—This subject is dealt with in a thorough manner by Dr. Arnold Feuerstein in the *Mitteilungen* of the Vienna Geographical Society, 1912, Nos. 5 and 6. The writer appears fully conversant with the previous literature on the subject, and has had assistance from such competent workers in the same field as Profs. Oberhummer and Wieser, under whose direction the remarkable maps of Austria-Hungary by Lazius were first reproduced in facsimile in 1906. Into the earlier maps Tirol entered merely as a section of a much larger area. Ptolemy's fifth and sixth maps give a very imperfect representation, no attempt being made to portray the inner topography of the mountains, while the positions of the chief places are very erroneous. A feature in these, as in other early maps, is the location of the source of the Danube in the Tirolese Alps. The Roman route-map known as the Peutinger Tafel, on the other hand, though merely diagrammatic, gives surprisingly accurate information as to the main routes and the distances between places. This, and still more the Antonine itinerary, bring out clearly the importance of the Brenner in the general system of communications. It was these maps rather than Ptolemy's that served as the basis for the mediæval "wheel-maps." An entirely new picture is given by the famous map of Fra Mauro, which makes the first attempt—and with some success—to depict the interior features of the Alps. Many errors and inaccuracies are, however, still to be seen. The important map of Germany by Nikolaus a Cusa, best known through the version of Henricus Martellus Germanus (about the end of the fifteenth century), is of special interest for the cartography of Tirol by reason of its author's long personal acquaintance with the region as Bishop of Brixen (1450–1460). A reduced facsimile of the Tirolese portion accompanies the paper. The main valleys and natural subdivisions of the Alps of Tirol are well shown. At the end of the fifteenth century a new and important type appears in the maps of Erhard Etzlaub—route-maps prepared for practical purposes. The Brenner route here appears in due prominence, with all the more important places on it. To this type belongs the 'Carta itineraria Europæ' of Waldseemüller (1511), though, apart from the itineraries, it may be regarded as a more or less independent production, marking a decided advance. Larger-scale maps of portions of the area begin with a remarkable representation of the surroundings of the Lake of Garda dating from before the middle of the fifteenth century. Other maps of this class are much later. Of those primarily concerned with bordering districts outside Tirol we have Aventin's map of Bavaria (1523 and 1533) and Setznagel's of Salzburg. The special mapping of Tirol received its first impetus from the residence at Innsbruck of the Emperor Maximilian I. The artistic and cartographical representation of the country encouraged by him reached its culmination somewhat later at the hands of the artist Paul Dax, whose many-sided activities included those of surveyor and map-maker to the Government. His productions take an important place in the general history of cartography. The work of Lazius already referred to was, on the other hand,

not that of an expert, though it is remarkable as the first atlas of Austria-Hungary, giving also the first general map of Tirol. This embodies the topographical results of the author's own journeys, but as the space allotted to various sections of the country depended on the amount of material available, the map (which is entirely without a degree net) can make no claim to geographical accuracy.

AFRICA.

The Proposed Brazzaville Railway, French Equatorial Africa.—After passing through a period of neglect, the project for a railway to connect a point on the Atlantic coast, within French territory, with Brazzaville on the navigable waters of the middle Congo, has of late years come into prominence as a matter of practical politics. The resuscitation was largely due to the initiative of M. Marc Bel, during whose mission in 1906 a preliminary survey was made, which showed the practicability of the idea. A more detailed examination of the proposed route was made in 1910–12 by a well-organized expedition under Captain J. Mornet, who has summarized the results before the Paris Geographical Society (*La Géographie*, November, 1912). The first part of the paper deals with the general question of the need and practicability of the scheme from a financial point of view. The author endeavours to show that the line need fear nothing from the competition of its Belgian rival, maintaining not only that the future traffic should be sufficient for both lines, but that in spite of its somewhat greater length the French railway would have positive advantages in its possession of an ocean port (at Point Noir), and in its broader gauge and other constructive details permitting the running of much heavier trains. Following this section is an account of the operations of the three separate survey parties into which the expedition was divided, and which undertook respectively three separate sections of the work. The difficulties encountered were very great, and so severe was the labour involved that only two out of the twenty-five Europeans employed were able to continue at their posts throughout. The first party found their task fairly easy while working on the plateau between the coast and the Loeme valley, but both here and beyond, as the spurs of the forest-clad Mayombe range were approached, their trials increased, until it became necessary for the whole party to return to France. The second party, entrusted with the study of possible routes across the Mayombe massif, had likewise a most trying task, and could find no possible crossing of the range which did not involve a summit tunnel of some length. Later, the search was renewed by a more circuitous route to the north, where a more feasible pass was at last discovered. The descent of the eastern versant was effected by a series of terraces leading down to the Niari valley. The third party, which started work from the Brazzaville end, found the river valleys of that region wholly impracticable for a railway, but discovered a feasible route along the water parting between the Jue and the Congo. Similar advantages had elsewhere been found to accrue from the choice of a water-parting rather than a river valley. In the central section, however, the valley of the Niari offers excellent facilities for railway construction, besides affording the most direct route; and Captain Mornet therefore recommends the abandonment of the former proposal to carry the line through the mineral area to the south. In the concluding section he discusses the inhabitants of the region traversed from the special point of view of the possible labour-supply for railway construction, showing that the Loango and Mayombe peoples, in the part nearer the coast, are good workers and more or less civilized, while further inland the inhabitants are wild and timid, and recruitment among them is likely to offer

much greater difficulties. Still he is sanguine as to the possibility of organizing in time a certain labour supply even here.

Water Supply in South Africa.—The *Minutes of Proceedings* of the Institution of Civil Engineers, vol. **188**, contains a paper by Mr. Edward Cecil Bartlett entitled "Investigations Relating to the Yield of a Catchment-Area in Cape Colony." Owing to a shortage in the water supply in parts of Cape Town and to the ownership by other corporations of sites for storage reservoirs on Table mountain, it became necessary to seek a source of supply outside the Cape peninsula, and the investigations discussed in this paper were undertaken to ascertain whether the total yield of the selected catchment-area would be sufficient for future requirements, and to obtain data relating to the river flow during the dry seasons. After a Government Commission had been appointed in 1902 to report on the water supply of the Cape peninsula, it was eventually decided to investigate the yield from the catchment-area of the Wemmers Hoek river, which is the only important tributary of the Berg river along the first 50 miles of its course. The catchment-area in question, situated 40 miles east of Cape Town, has an area of 34½ square miles, and is surrounded by mountains composed of quartzitic sandstone belonging to the Table mountain series. The more lofty of these mountains, reaching a height between 3000 and 5000 feet above sea-level and intersected by ravines, are very precipitous and barren at the higher levels, which are frequently covered with snow in winter. Half of the catchment-area, which is seldom less than 2500 feet above the sea, is swept in the wet season by prevalent north-westerly winds from the sea. The water of the Wemmers Hoek river is clear and colourless, and even in flood carries very little silt. The mean annual rainfall over its catchment-area is computed from a system of rain-gauge observations to be from 70 to 80 inches. The maximum rate of flow of the river measured during the flood-time of 1907 was 1,454,500,000 gallons a day, which is equivalent to a discharge of 7·3 cubic feet per minute per acre. As a portion of the rain which falls during the earlier months of the wet season (May to October) is stored up in the deposits of the valley and talus slopes, the percentage yield during the wet season, as measured by the river-discharge, appears less than its true quantity, while the yield during the dry season, when the stored water is given up and constitutes the larger portion of the river flow, will appear greater than it actually is. It is found that the yield from this and neighbouring catchment-areas depends more on the rain which falls during the six wet months than on the annual rainfall. The scheme with which Mr. Bartlett's paper deals, received the sanction of the Cape Legislature in August, 1907. "Compensation water" to the value of 5½ million gallons per day had to be provided for riparian rights. Farmers in South Africa are dependent on the rivers for irrigation, watering cattle and domestic washing, so that, though water may be urgently needed for town corporations, they always strongly oppose any proposal to conduct it from one watershed to another.

Ascents of Volcanoes in Nyasaland.—News has been received from the expedition of the well-known Russian geologist and explorer, Mr. Egon F. Kirschstein, stating that, during October and November of last year, he ascended the volcanoes in the Konde region, north of Lake Nyasa. The scientific results have been remarkable in every respect. Among other matters, it was possible to solve the question as to the subsoil conditions of the volcano region. The geological formation of the volcanoes and their relation to the structure have been explained, and new craters have been found and entered on the map. Mr. Kirschstein, it will be remembered, did good work in the

investigation of the Kirunga volcanoes during the Duke of Mecklenburg's expedition in 1907–08. The expedition is now travelling through the north-western highlands of Nyasaland, from whence it will proceed to Tanganyika. The party is expected at Ujiji by the end of March. Mr. Kirschstein has made extensive ethnographical collections in the territories through which he has travelled, and they are intended for the museum of the Academy of Science at St. Petersburg.

AMERICA.

Southern Vancouver Island.—The hitherto little-known interior of this island seems at last likely to be opened up with some rapidity. An important recent contribution to our knowledge of the southern portion is supplied by Mr. Charles H. Clapp in 'Memoir No. 13' of the Canadian Geological Survey (Ottawa, 1912). This Memoir, which extends to 202 pages, presents the preliminary results of reconnaissances in 1908 and 1909, and of more detailed work in a part of the area in 1910. The tract described covers approximately 4000 square miles, lying south of the Alberni-Nanaimo road, and east of the Alberni canal and Barclay sound. A part of this area is accessible by road, while railway and tramway extensions are either being built or projected to open up the interior. Away from the roads, most of the existing trails are not wide enough for pack-animals, so that transport can be effected by men only. The greater part of the report is of a technical nature, giving a detailed account of the geology, but there is a preliminary section on the general character of the district, in which the evolution of the present surface is discussed according to the method originated by Prof. W. M. Davis, under whose supervision this section was written. Vancouver island is described as "a mountain range, characterized by both flat-topped and ridge-like summits, . . . the result of the mature dissection of an uplifted, subdued surface formed during a Tertiary erosion-cycle, acting on a heterogeneous group of deformed rocks." It is one of the border ranges which mark the western shore of the American continents, lying west of the great marginal depression known as the Pacific coast downfold. Before uplift the Tertiary erosion surface had reached a stage varying from late maturity to old age. In the southern part it formed a peneplain with rounded hills a few hundred feet above the general level, while in the centre larger and higher monadnocks and small ranges have survived, reaching elevations of from 5000 to 7000 feet above sea-level. The surface was maturely dissected during a pre-glacial cycle by transverse rivers with large subsequent tributaries. The softer rocks along the east coast were reduced more nearly to base level, while a coastal plain which had been built up against a submerged mountainous slope was, after uplift, eroded nearly to base level. During the glacial period the island was apparently smothered by a thick ice-cap, reaching to 4000 feet or more above sea-level. Valley heads in the higher mountains were excavated by local glaciers, the mountains now showing serrated summits. Valley glaciers occupied and scoured out the larger valleys, converting many in the west into fiords. The Tertiary cycle reached its most advanced development in the southern part of the island, and the pre-glacial dissection of the peneplain likewise became more and more mature in a south-easterly direction. A new surface of low relief, now only 200 to 300 feet above sea-level, was here developed. Two main systems of valleys—the one transverse to, the other conforming to, the strike of the underlying rocks—dissect the uplifted Tertiary erosion surface. The larger ones, especially the transverse, show the characters of mature glaciation. The "subsequent" strike valleys are, as a rule, wider and more extensive than the transverse ones, but have not been subjected to such severe

glaciation. The climate varies greatly between the east and west coasts, the rainfall on the outer side reaching 120 inches yearly, while on the lee side of the main range the amount sinks to from 30 to 60 inches. Most falls in the summer months. The temperature is very uniform on the coasts, but varies more in the interior. Not more than 10 per cent. of the whole area is suited for farming purposes, timber forming the chief natural asset.

Canadian Hydrographical Work in 1911-12.—The report of the Canadian Department of the Naval Service for the year ending March 31, 1912, contains some interesting items respecting the progress during the year of the survey of tides and currents, and of the hydrographic survey. Of the six tidal stations in Eastern Canada and the five on the Pacific coast, most had been maintained in almost continuous operation throughout the year, while thirteen complete years of tidal record had been reduced and submitted to harmonic analysis, permitting a substantial improvement in the accuracy of the tide tables. Those for Eastern Canada are now more accurate than any for the Atlantic coast of the United States, with the exception of Charlottetown; while three of the Pacific Coast reference stations are equal or superior in accuracy to those for any other ports on the Pacific ocean. During the period under review an important investigation of the currents in the entrance to the St. Lawrence was carried out with the help of the coast-guard steamer *Gulnare*, under the personal supervision of the superintendent, Mr. W. Bell Dawson. Its results should prove of great value to shipping, especially with regard to the Gaspé current, which maintains a constant downward set along the Gaspé coast, on the south side of the estuary, though varying in speed with the tide and the distance from the shore. Nearer Anticosti the currents show a continuous right-hand veer round the compass within the tidal period, though the water makes westward on the whole. Contrary to the accepted opinion, the ordinary winds were found to have hardly any perceptible effect on the current, though with off-shore winds from the south-west it may be displaced outwards. Among the tidal observations lately secured are those taken by Mr. J. T. E. Lavoie during Captain Bernier's latest expedition in the *Arctic*. Made with a modern type of instrument, they will afford valuable information regarding the little-known tidal *régime* of the Arctic seas. A series of observations taken in Hudson strait during Lieut. Gordon's expeditions of 1884-86 has been rescued from oblivion, and should prove valuable now that the navigation to Hudson bay is again attracting attention. The report on hydrographic surveys is important for the account of the work in 1911 in Hudson bay in continuance of that in 1910 referred to in the *Journal* a year ago (vol. 39, p. 398). It was vigorously prosecuted by three parties, the principal being under the charge of Captain F. Anderson in the ice-breaker *Minto*. His account shows the dangers and trials which ordinary well-found vessels may expect in navigating Hudson strait. The three vessels employed had all been specially strengthened, yet all suffered more or less. Even the *Minto*, which had suffered little during many years' winter navigation across Northumberland strait, had her bow badly damaged, the ice being much harder than that met with farther south. Had the schooners been bound in for cargo, neither could have brought out a ton. In the bay the principal task was the survey of Port Nelson, carried out amid the difficulties arising from low shores, scarcity of material for survey marks, the landing of instruments, etc., across mud-flats 2 to 4 miles wide, the distance from the shore at which soundings had to be taken, and the short, cold, and wet season. The objections to the port for shipping purposes consist in the length, narrowness, and moderate depth of the navigable channel, the wide boulder-strewn flats on

either side, the bar, with only 18 feet of water at most, exposed to the full sweep of the sea, and the absence of natural marks to guide vessels in. The impression gained during the previous year's work of the superiority of Port Churchill from many points of view seems to have been confirmed by the later work.

Recent Fault-Scarps in Nevada.—The close connection known to exist between earthquakes and faulting of the surface layers of the earth's crust renders the study of fault-scarps bearing evidence of recent date of much importance to seismology, even where the formation of the scarps cannot be assigned to any known earthquake. A series of such scarps was referred to by Russell (in his monograph on Lake Lahontan) as occurring on the eastern face of the Sierra Nevada, along the western border of Carson and Eagle valleys in Nevada, but was not described in detail. The want has been supplied, as regards the scarps in the vicinity of Genoa, Nevada, by Mr. A. C. Lawson, who gives a careful description, with photographs of the scarps, in the *Bulletin of the Seismological Society of America*, vol. 2, No. 3 (September, 1912). The scarps occur near the base of the steep slope of Genoa peak, upon which the flat floor of Carson valley abuts with great abruptness. Although they have been taken for ancient water-marks, a close examination shows that they have never been horizontal and that their lacustrine origin is imaginary. Their appearance is so fresh as to suggest that the displacement might have occurred within living memory, but reference to the oldest inhabitants elicited the statement that in 1854 the scarps were apparently in the same condition as to-day. The best displayed scarp has a polished and slicken-sided hard rock surface, with a dip of 65°. Even where one of the scarps cuts through an alluvial embankment, the angle of slope has been maintained at about 36°, while the maximum slope of the alluvial surface is 7°. The greatest vertical component measured was about 44 feet. From his observations of these scarps, Mr. Lawson concludes that the faults on the eastern front of the Sierra Nevada west of Carson valley are disposed in zigzag fashion, closely coincident with the basis of the mountain facets. The displacement was not wholly one of uplifting of the mountain block, but there has been a pronounced drop of the valley block. Judging from the amount of displacement this was doubtless accompanied by an earthquake of the first class, and we may expect in the not distant future a renewal of the displacement somewhere in the same fault-zone, accompanied by a heavy earthquake.

AUSTRALASIA AND PACIFIC ISLANDS.

The Coal Resources of New South Wales.—Under this title a useful summary of facts at present known in regard to the coal deposits of New South Wales, by the Government geologist, Mr. E. F. Pittman, has been issued by the Geological Survey of that State (Sydney, 1912, price 1s.), forming virtually a second edition, brought up to date by reference to recent developments, of the article on coal included in 'The Mineral Resources of New South Wales, 1901.' It is pointed out that coal constitutes the most important of the varied mineral resources of New South Wales, and that the deposits are here both of much greater extent, and of much better quality, than those of the other Australian states. This must ultimately cause New South Wales to become the chief centre of manufacturing industries in Australia, if not in the whole Southern Hemisphere. For a distance of 200 miles the deposits extend along the seaboard, so that they are excellently situated for export. The discovery of coal in the State dates back to 1797, in which year it was found in the sea-cliffs in both the existing northern and

southern coalfields. The report deals briefly with the geology of the coal-bearing rocks, on the basis of the labours of many students, from the Rev. W. B. Clarke to Prof. David and others within recent years. Beginning with the most recent deposits, those of Tertiary age consist of lignite, and cannot be considered of commercial importance. The Mesozoic measures (probably either Triassic or Trias-Jura) contain at least five seams of coal with shale bands, but the latter forms everywhere the greater part of the seam. The coal may be classed as a steam coal, but the percentage of ash is too high to allow of its export for this purpose. It may, however, be worked in the future for local purposes. Of the Palæozoic deposits those known as Permo-Carboniferous from the great store-house of productive coal-seams in New South Wales. They occupy an area of about 16,000 square miles, the main coal basin extending nearly 200 miles along the eastern coast; the greatest width, from Newcastle to Rylstone, being about 100 miles. The deepest part of the basin is somewhere in the neighbourhood of Sydney, where the "Sydney Harbour Colliery" is working the uppermost seam at a depth of 2884 feet. The Upper or Newcastle measures show the greatest surface development of any of the rocks of this age, and are worked in the northern, southern, and western coalfields. Near the base of the whole series occur the Greta measures, cropping out as a narrow belt of conglomerates, sandstones, shales, and coal-seams. The Greta coal-seams are being very extensively worked in the northern coalfield between West Maitland and Cessnock—a stretch of country which is at present by far the most important coal-mining district in Australasia. Boring operations have shown that the Newcastle measures extend continuously beneath the whole basin, but the seams vary greatly both in thickness and quality within short distances. A rough estimate gives a total quantity of 115,846,880,000 tons of available fuel in the Permo-Carboniferous measures above 4000 feet. The report includes a large number of recent analyses of New South Wales coal.

"Gilgai" Country in New South Wales.—Near the western foot of the dividing range in New South Wales there is a considerable extent of country of a remarkable character to which the name "Gilgai" is locally applied. It is extremely uneven, consisting of alternate hummocks and hollows, and showing some analogy with the types of surface known elsewhere as melon-hole or crab-hole country, though differing in the much emphasized relief. A description of this country, with an attempt to offer an explanation of its mode of origin, is given in the *Journal and Proceedings of the Royal Society of New South Wales* (vol. 45, Part III.), by Dr. H. I. Jensen, who remarks that no description of the feature appears to have been previously published, though it has often been observed by surveyors and others. The hummocks are sometimes rounded in outline, but are more often of irregular shape, *e.g.* serpentine, vermiform, or variously ramified. Their elevation above the hollows may amount to 10 or 20 feet, though their crests may be only 25 to 50 feet apart. The country is far too rough to ride over even when cleared. Gilgai country may occur in areas from a few acres to several square miles, and along the northern edge of the "Pilliga" scrub they follow each other so closely as to form a regular belt. The general distribution seems to be at the base of the western slopes, in the zone between areas of denudation and the black and red soil planes of the west, where aggradation has been great and where signs of late tertiary subsidence are often to be seen. In the Pilliga scrub area this form of surface is covered with dense "brigalow" (*Acacia*) and "pelar" (*Casuarina*) scrubs, with but slight admixture of other trees. The vegetation grows mainly on the hummocks, and is characterized by abundant surface roots with no tap-roots. The soils are mostly dark grey or almost

black clays, irregular and somewhat abnormal in chemical composition, being high in lime, soda, and magnesia, but low in phosphoric acid and potash. Dr. Jensen discusses in turn various theories that have been advanced to explain the origin of Gilgai country (collapse of substrata, removal of soluble ingredients, wind action, mud springs, etc.) and finds them all not quite satisfactory. His own suggestion is closely connected with probable fluctuations of climate in late tertiary and subsequent epochs. A wet period seems to have been followed by one much dryer than the present, during which the drainage became disintegrated, and the Gilgai area was occupied first by a lake without outlet, afterwards by a series of salty marshes, fed by trickles of water from mudsprings on higher ground, but dry at intervals. The contraction of the clays on drying, the growth of tussocky grasses, with chemical precipitation on the tussocks, is thought by Dr. Jensen to have given rise to a hummocky surface, while under subsequent moister conditions the hummocks may not only have been preserved by vegetation, but accentuated by the capillary migration of salts and carbonates of lime and magnesia.

POLAR REGIONS.

French Scientific Expedition to Franz Josef Land.—It is announced that a French expedition for the scientific exploration of the little-known north-eastern part of the Franz Josef Land Archipelago is being organized, with the approval of the French Government, by M. Jules de Payer, son of the Austrian discoverer of Franz Josef Land. M. de Payer, who is a French citizen, has for some time been preparing himself for Arctic work by scientific study. His staff will include a naval lieutenant, an army and a navy doctor, a military airman, and a geologist. In order to avoid the disaster which overtook the *Tegethoff* (the ship of the Austrian expedition), it is proposed to establish a base in Franz Josef Land, sending the ship home before the winter, during which scientific work would be carried on at the base. During the succeeding summer a varied programme would be executed with the help of a boat with auxiliary power and two aeroplanes.

Mr. Stefansson's New Expedition.—Mr. Stefansson has secured the support of the Canadian Government for his new expedition (*Journal*, February, p. 172), which will thus be carried out under Canadian, not American, auspices. A grant of £15,000 has been made towards the expenses of the expedition by the Dominion Government, and its work will be carried out under the Geological Survey of Canada. The leader will be assisted by students possessed of scientific training, and it is stated that he is prepared to spend three winters and four summers in the far north for the purpose of the proposed investigations. The work of the expedition will include the establishment of Canadian sovereignty over the part of the Archipelago visited.

The German Arctic Expedition.—The Norwegian search party, which set out from Advent bay for the relief of the German party under Lieut. Schröder-Stranz, is stated to have returned without accomplishing their object, having suffered severely from frost-bite. Grave fears are entertained for the safety of the German explorers, for whose rescue the resources available at the camp at Advent bay appear quite insufficient. The Norwegian Government has, however, taken steps to despatch a relief expedition at the earliest possible moment.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ice Observation in the North Atlantic.—Dr. Bruce's old ship, the *Scotia*, has been chartered under an arrangement between the Board of Trade

and the principal Atlantic steamship companies, for the purpose of ice observation in the vicinity of the steamship routes across the North Atlantic. The vessel will be stationed during the coming spring off the east coast of North America, to watch the break-up of the ice and report its movements. She was expected to be ready to leave Dundee about the end of February, after being fitted with a wireless installation of long range to enable her to keep in touch with stations in Newfoundland and Labrador. Three scientific experts will be in charge of the observations, and it is hoped that they will also be able to carry out general scientific work in the domain of oceanography and meteorology.

Light Penetration in Sea-water.—Following up a photogeographic method devised by Dr. W. F. Ewald, Mr. K. Grein has lately carried out some interesting experiments with a view to finding out the varying degrees of vertical penetration into sea-water displayed by the different components of the solar spectrum. They were made at the Oceanographical Museum at Monaco, in June and July, 1912, and a preliminary account of the results has since been issued as *Bulletin* No. 249 of the Oceanographical Institute at the same place. While previous experiments had been carried out with sensitive paper, this was replaced in the later series by rapid panchromatic plates (supplied by Wratten and Wainwright, of Croydon), which necessitated the employment of an improved kind of photometer. Of the different coloured rays, red were investigated to a depth of 100 metres, and the rest to a progressively increasing depth, down to 1500 metres for the blue-violet. The results are displayed in three tables, of which the first records the amount of light penetrating to different depths in the case of the successive colours; the second shows the diminution of light in the several cases, in thousandths of the amount received at 1 metre; while the third shows the part played by the different portions of the spectrum in the composition of the total light received at various depths. The immense difference in the penetrating power of the different rays is well brought out by these tables, the amount of light derived from the red rays at 50 metres (where their effect ceases entirely) being, *e.g.*, only equal to that from the blue-violet at 500 metres. Again, at 5 metres the red rays have fallen to 3·7 thousandths of their amount at 1 metre, while the blue violet-rays remain as high as 866 thousandths. Broadly speaking, the penetration diminishes fairly regularly from red to violet, though one or two irregularities occur, which will no doubt be explained in the more detailed memoir promised. Thus at 200 metres the blue-violet rays supply 952 thousandths of the total light received, but the proportion falls to 888·1 thousandths at 1000 metres, the blue-green meanwhile showing a decided increase.

GENERAL.

Time in the French Colonies.—According to a note in the *Bulletin* of the Lille Geographical Society (November, 1912) the time adopted in the various French colonies has been brought into harmony with that now in legal force in France (*Journal*, vol. 37, p. 312) and so with the general system of hour zones throughout the world. In comparison with French time (itself coincident with that of Western Europe in general) the intervals are as follows: (*a*) In advance of France: New Caledonia and New Hebrides, 11 hours; Indo-China, 7 hours; Madagascar and Dependencies, 5½ hours; Réunion, 4 hours; Somali Coast, 3 hours; Equatorial Africa, 1 hour. (*b*) Behind France: Martinique, Guadeloupe, French Guiana, St. Pierre and Miquelon, 4 hours; French Oceania, 10 hours. In French West Africa the time will in different section be one hour in advance, one hour behind, or coincident with that of France.

OBITUARY.

The Earl of Crawford.

In the person of the late Earl of Crawford and Balcarres, who died at his house in London on January 31, 1913, the Society has lost a Fellow of over forty years' standing, whose interests had touched geography on several different sides. James Ludovic Lindsay, twenty-sixth Earl of Crawford, was born on July 28, 1847, being the son of the twenty-fifth Earl. He was educated at Eton and Trinity, Cambridge, taking up astronomy as a special subject of study, for which his decided mathematical bent supplied an excellent training. In association with his father he built an observatory at Dunecht, Aberdeenshire, and presented it to the nation, accompanied by a valuable library, afterwards housed at the New Royal Observatory, Edinburgh. In 1870 he made a voyage to Cadiz to observe an eclipse of the sun, and in 1874 visited Mauritius for the purpose of observing the transit of Venus. It was for this expedition that he devised the special form of heliometer since associated with his name. An enthusiastic yachtsman, and a sufferer from rheumatism and asthma, he made many voyages to the South for the benefit of his health, the most extensive being that undertaken in November, 1905, which took him in various directions across the Atlantic and Indian oceans, with halts at continental ports and out-of-the-way islands. Having taken with him a trained ornithologist in the person of Mr. M. J. Nicoll, he was able to make valuable contributions to science by the collections brought back. Mr. Nicoll eventually wrote an account of the cruises under the title 'Three Voyages of a Naturalist' (1908), to which the Earl supplied an introduction.

In quite another direction the late Earl contributed to geographical science through his fine library at his residence at Haigh Hall, near Wigan (which borough he represented in Parliament from 1874 to 1880). Among the treasures therein contained is the famous manuscript map by Pierre Desceliers, of date 1546, which is notable for its representation, as in other examples produced by the Dieppe school, of a vast continental land in the far south-east, supposed by some to represent Australia. In 1898 the Earl did a service to all students of the history of cartography by publishing a fine facsimile of this map, as also of two others of the same school preserved in the British Museum, with an introduction by Mr. C. H. Coote.

The late Earl married, in 1869, Emily Florence, daughter of the late Colonel the Hon. Edward Bootle-Wilbraham, and leaves five sons and one daughter.

CORRESPONDENCE.

The History of the Exploration of the Upper Dihong.

In June, 1878, Lieut. H. J. Harman, R.E., engaged Nem Singh (G.M.N.), a lama of a monastery in Sikkhim, to teach him Tibetan.

This man was a good Hindustani scholar, well read in his own language and Tibetan literature, and had a slight knowledge of English ('General Report, Survey of India, 1877–79.' Appendix).

Lieut. Harman, finding him intelligent and industrious, taught him surveying and offered him service as an explorer. Nem Singh soon learnt traversing with the prismatic compass, and how to plot his work, to use the boiling-point thermometer, to read a Hedley's sextant, and to understand maps.

Lieut. Harman decided that it was better to send him off imperfectly trained

than to lose a season, so in August, 1878, Nem Singh was despatched with instructions to trace the Tsang Po from Chetang downwards as far as he was able.

Nem Singh reached Chetang in October, journeying thither by way of Lhasa; and from Chetang he travelled some 290 miles east along the Tsang Po, till he came to Gya La Dzong (long. 94°). Here he turned back, arriving in Darjeeling again in January, 1879.

The height Nem Singh assigned to Gya La Dzong was 8000 feet, being a 2000-feet drop in the course of the river from Chetang. He stated that the river at Gya La Dzong is 450 feet wide, though deep and with moderate current.

Nem Singh was told that there was a report to the effect that the river, after flowing through the Gimuchen country, entered a land ruled by the British.

The bend of the Tsang Po in Tibet at Gya La Dzong is derived from Nem Singh's compass traverse. This traverse is recognized to be very weak and unreliable, and grave doubts have been felt about it, but it is the only information we have hitherto possessed.

Lieut. Harman at the time carefully questioned the explorer, and considered his work "sufficiently trustworthy for geographical work."

It has since been discovered, from the work of the Abor Expedition, that the bend should be moved more to the east.

With Nem Singh was one Kinthup, also a native of Sikkhim, who later on was destined to become an explorer on his own account.

In July, 1880, Lieut. Harman despatched a Chinese lama of Giardong with orders to explore the country below Gya La Dzong, and trace the Tsang Po to the plains of India, or, failing this, to throw marked logs into the stream at the lowest point reached. Kinthup was sent with this lama as his assistant.

It was intended that due notice should be given by the lama to Lieut. Harman of the period during which logs were daily to be cast into the river, so that he might set watchers on the Dihong, and thus prove the identity or otherwise of the great river of Tibet with the Brahmaputra.

The Lama, however, played false, and sold the unfortunate Kinthup into slavery at a place called Tongjuk Dzong, 20 miles north of Gya La Dzong. A little south of this place are the famous falls of the Tsang Po, the description of which, as given by Kinthup, is, "The Tsang Po falls over a cliff called Sinji Chogyal, from a height of 150 feet. There is a big lake at the foot of the falls, where rainbows are always observable."

Kinthup remained ten months in captivity, and then managed to escape to Marpung, some 60 or 70 miles south. Here he heard that his late master had sent men to arrest him, so he went and made obeisance to the head lama of the big monastery there, and told him all that had happened. The lama showed him kindness, and ransomed him for a sum of about £3. Kinthup served under this lama for four and a half months, when he took leave on the pretence of going on a pilgrimage. While "on leave" he cut some five hundred logs of a peculiar shape, with the intention of eventually throwing them into the Tsang Po, to see if they would float down the Dihong; these logs he hid in a cave.

Kinthup then returned to his lama, and after a two months' service took leave again, this time going to Lhasa. At Lhasa he wrote to India that he had prepared the five hundred logs as ordered by the late Captain Harman, and that he was prepared to throw fifty logs per day into the Tsang Po from the fifth to the fifteenth of the tenth Tibetan month of the year. This letter was written for Kinthup by a Kazi of Sikkhim, whose wife took the letter to Darjeeling, but it never reached its destination.

Kinthup then went back to the Marpung lama and served for another nine months, when the lama set him free.

Kinthup's first act was to go and throw the five hundred logs he had made into the river; he then stayed a month to earn sufficient money for his journey back into India, and then set off down the Tsang Po once more.

He eventually reached a place which he called Onlet, which he ascertained was about 45 miles from the British Government boundary, but the Abors would not let him pass through; so he had to retrace his steps all the way back along the Tsang Po, eventually reaching Darjeeling in November, 1884.

Kinthup's narrative was dictated by him to the lama "V. G.," and translated into English from the original by Norpu, an employé of the Survey Department It was subsequently compiled by Colonel Tanner.

From this it will be seen that the evidence of the existence of the falls on the Tsang Po rests on the evidence of Kinthup alone. What reliance can we place on his testimony? *

In the first place, it is practically certain that he did make the journey that he describes, because during this recent Abor expedition the course of the Dihong north of Kinthup's "Onlet" was surveyed for some 40 miles, and the names of the villages along its course agree remarkably well with the names given by Kinthup in his report of some twenty-eight years before. This is in itself a good piece of evidence of the identity of the Tsang Po and the Dihong.

The fact that the names and descriptions of the villages do not tally exactly with those found by the recent Abor Expedition is not in the least surprising. It must be remembered that the account was dictated a year after the events took place. It is marvellous to see how accurate his description really is.

Secondly, Kinthup in his report speaks of the rainbows at the foot of the falls. Now, this is not the sort of thing that a man would say if he were fabricating a story. It is inconceivable that an uneducated native would invent such a statement as this, while it is, of course, such a phenomenon that would inevitably occur, owing to the mist and spray that would be formed by a mighty river falling over a cliff 150 feet high.

The criticisms of his senior officers at the time were:—

Lieut.-Colonel G. Strahan, R.E., Officiating Deputy Surveyor-General, Trigonometrical Branch, December, 1888 ('Report on Exploration in Sikkim, Bhutan, and Thibet, 1889.' Introduction)—

"This man not being a trained explorer, the information he brought is not based on a route survey, and can only be regarded as a *bonâ fide* story of his travels, related from recollection two years after his return."

Colonel H. C. Tanner, in 1887—

"He has been cross-examined and questioned by myself regarding his statements, and I have no doubt that his account is a *bonâ fide* story of his travels" (page lxxxix., 'General Report, Survey of India, 1886–87').

J. A. Field,
Lieutenant R.E.,
Abor Survey Detachment.

The Tsang-po and the Dihong.

61, Melville Street, Edinburgh, February 15, 1913.

Referring to Mr. Bentinck's revealing paper and to the interesting discussion on the Abor expedition, reported in the *Geographical Journal* of February, I venture

* The testimony of certain Tibetans interviewed by Colonel Waddell of the Indian Medical Department should not be ignored, *vide* vol. 5 of the *Journal*, p. 258.—T. H. H.

to point out the obvious fallacy of the arguments upon which Captain L. A. Bethell bases his theory that the Tsang-po of Tibet and the Dihong of India are not likely to be one and the same river, the latter being, in his view, only a local river with a large drainage area in the hills of the southern watershed of the Himalayas, whilst the Tsang-po is left to mysteriously disappear on the northern side.

Captain Bethell avers that at Chaksam, in Tibet, the Tsang-po, in the rainy season of 1904, struck him as a very big river indeed, whilst in India the Dihong at Pasighat, where it emerges from the hills into the plains, appeared, in the same season eight years later (1912), actually smaller than the Tsang-po 700 miles further up.

The absence of any actual measurements or even estimate of volume and velocity at either of these points renders that evidence *per se* of doubtful value; moreover, the apparent shrinkage of rivers at different points is a deceptive and frequent phenomenon, notably in the course of Alpine rivers. For instance, the Rhine, just below its outflow from the Lake of Constance, looks a much bigger river than it does above and below the falls of Schaffhausen. The river Aare—the largest affluent of the Rhine in Switzerland, after leaving the lakes of Neuchâtel and Bienne, is about 100 yards in width, whereas further down, at Brugg, it is, at a certain point, reduced to a channel of 3 or 4 yards. The same applies to the Rhone at its outflow from the Lake of Geneva, whilst lower down, at Bellegarde, the *perte du Rhone* is only a few yards in width.

Equally fallacious is Captain Bethell's argument of the extreme sensitiveness of the Dihong at Pasighat, in suddenly rising and falling during or after a storm, as showing that probably it is not the Tsang-po, but only a local river. Every main river of considerable length has its local and partial floods caused by a sudden rise of this or that affluent within its own drainage area. Thus the river Arve and the Saône, which discharge into the Rhone below Geneva and Lyons respectively, often cause the latter to rise suddenly and be discoloured, whilst above and some distance below the points of confluence, the flow and colour of the main river are normal. The same applies to the Rhine, where the local effect of a rise of its successive affluents, such as the Neckar, the Main, the Lahn, the Moselle, etc., is well known by the characteristic colour of each independently of the floods of the Rhine itself. Such examples might be multiplied *ad infinitum*. Moreover, even if the Dihong were only a local river, it would be difficult to reconcile its enormous catchment-area with the "insignificant and skittish thing" as which Captain Bethell describes it.

One point which seems not to have been ventilated in the discussion is the possibility of the Tsang-po, after its deflection to the south at the point of least resistance, whence it eroded its way through the Himalayas—losing itself for part of its course in subterranean passages. The most familiar instance of such an underground course is, of course, the *perte du Rhone* at Bellegarde, though close by there is a similar but little-known one in a torrential tributary, the Valsérine. A remarkable case of underground deflection occurred quite recently, also in the Jura, during the construction of the Mont d'Or tunnel, where a large torrent, which rises in that mountain and supplies several villages and mills on the French side of the watershed east of Pontarlier, suddenly burst into the tunnel and discharged its entire volume into the river Orbe near Vallorbe, on the Swiss side of the Jura.

But whether such subterranean sections occur in the southward course of the Dihong or not, there is no reason to doubt Kinthup's testimony strengthened by the verbal reports which Mr. Bentinck collected from Asau, the Simong Gam, and the Tibetans at Gette, that the Tsang-po and the Dihong are one and the same river. Discarding the waterfalls and cataract theory, the course of the river in the

unexplored upper part of the Himalayas will probably turn out to be a very rational and normal one. No doubt the Tsang-po will be found to flow across the mountain range—as Sir Hamilton Bower and Sir Thomas Holdich predict—in a stupendous gorge; for the rest nothing more romantic will probably be encountered in that upper section than a succession of rapids similar to those met by Mr. Bentinck in the lower.

The solution of the absorbing problem of the upper Brahmaputra (formed by the Tsang-po and the Dihong) will mark the final disappearance from the map of India of the tantalizing dotted line of a few hundred miles across the Himalayas. It would have disappeared ere now had Sir Francis Younghusband, when at Lhasa in 1904, been allowed to despatch the exploring party which he had already organized and equipped for the purpose.

Dr. Du Riche Preller, F.G.S., F.R.G.S., F.R.S.E.

The Peru-Bolivian Boundary.

Peru-Bolivian Boundary Commission,
al cuidado del Ministerio de R.R. E.E., Uinto, Peru.

I see in your Journal, July, 1912, a paragraph *re* the Peru-Bolivian Boundary, the last sentence of which, "The commissioners have now fixed the entire line of the frontier between Peru and Bolivia," seems to me rather misleading, and it might be interpreted that the work in the field had been actually finished. This is not the case. I have been in technical charge of the work for the Peruvian Commission this year, and my party has just returned to Uinto for recess during the rains.

The actual boundary-line was agreed to *on paper* between the respective governments as stated in your Journal. The work of demarcation on the ground has been in progress throughout this season, and will continue in 1913, when we hope to finish. The placing of pillars on the sections finished last year was concluded during the dry season of 1912 by a sub-commission especially told off for this purpose.

It will probably be some two months before we can get our calculations worked out and in shape, and I then purpose forwarding you a summary of results and short account of the work done.

Harry Toppin,
Captain 5th Fusiliers.

"Mountain Sickness."

January 20, 1913.

From a letter which my colleague, A. F. Kuehn, a consulting mining engineer, has written to me, I extract the following information.

Mr. Kuehn lived in Peru and Bolivia for about two years, at altitudes of from 11,000 to 14,000 feet. He was in excellent health when he went to "Peru with twelve skilled smelter-men, artisans, and miners, all of whom were also in excellent health when we left the sea-level for the higher altitudes. We travelled by railway, and in about ten hours had passed the maximum altitude of 15,665 feet, and descended to about 12,000 feet, where we spent the night. The train stopped for a short time at the highest altitude, and while taking a walk on the station platform two of the men fainted. That night I had a headache and nausea, and was unable to sleep.

"The next day we continued our journey by rail to an altitude of 14,600 feet. At the journey's end I was too ill to care about anything. As I recollect, I slept about an hour the first night, and thereafter gained about an additional hour, until I slept normally.

"Returning to sea-level from the high altitudes in no way inconvenienced me, but I have, on several occasions, noticed that others suffered the same effects when descending from the high altitudes to sea-level as in ascending from sea-level."

W. H. Shockley.

The Salinity of Walker Lake.

39, East Fourth Street, Mount Vernon, N.Y., February 18, 1913.

Referring to the salinity of Walker lake, to which Mr. Shockley calls my attention, I perhaps exaggerated the facts of the case in stating that it was a saturated *brine*. In my time in that region, saturation extended only so far as calcium carbonate is concerned; there was no deposit of sodium salts, although the water was strongly saline. At that time, 1867, there apparently were no mollusks in the lake, and I do now recall that there were fish; I think, however, there were fish in the Walker river, its only feeder. I do not question Mr. Shockley's statement in the matter of purchasing fish of the natives; possibly it was another instance in which his leg was pulled. Twenty years ago the *Journal*—or *Bulletin* it was then—misprinted Lake Lahontan for me.

J. W. Redway.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1912–1913.

Sixth Meeting, January 27, 1913. Major Leonard Darwin, Vice-President, in the Chair.

Elections.—*Gilbert Anderson; Rev. I. H. Shackleton Bailey; Charles Schoo Barton; Henry Adolphus Cartwright; William Harry Coombs; John Wilfrid Earle; Herbert Archer Edwards; J. Elliot Elliott; Field-Marshall the Right Hon. Lord Grenfell, G.C.B., G.C.M.G.; Ernest John Harrison; Lieut.-Colonel G. V. Holmes, I.A.; Gordon Lewis Jacobs; H. H. Raj Rana Sir Bhawani Singh Bahadur, K.C.S.I.; Frank Edward Johnson; Edgar G. Lister; Oswald Partington; Alfred Ernest Pratt; Herbert K. Scott; Allan Gibson Steel.*

The Paper read was:—

"Morocco." By Allan G. Ogilvie.

Seventh Meeting, February 10, 1913.—Douglas W. Freshfield, Esq., Vice-President, in the Chair.

Elections.—*Mrs. John Annan; Miss Emma Cecilia Bell; Miss Gertrude Bell; George Gordon Brown; Rear-Admiral Montague Edward Browning; Mrs.*

Annie Candler; Miss Christie; Carlos B. Cisneros; H. J. Elwes; Charles Bungay Fawcett; Miss Katherine Feilden; Mrs. Mildred Susan Fox; Miss Mabel Fraser; Captain I. L. Grinlinton, R.E.; Miss Amabel Jane Head; Mrs. M. R. I. Longstaff; Percy Cunningham Oswald; Mrs. Henry Paget; Lieut.-Colonel Alexander Pringle, I.A.; Miss Ariadne Rodocanachi; Mrs. W. E. Scott; Jordan Herbert Stabler; Miss Susette M. Taylor; Mrs. Olive Susan Mirande C. Temple; Miss Vaughan.

The reading of the paper on the Balkan Peninsula was postponed, and the Chairman gave a short address on the sad disaster which had overtaken Captain Scott and his four comrades on their return from the South Pole (see p. 203).

Eighth Meeting, February 24, 1913.—The Right Hon. Earl Curzon of Kedleston, G.C.S.I., G.C.I.E., etc., President, in the Chair.

Elections.—*Colonel H. E. F. Goold-Adams, C.M.G., R.A.; Miss Clara Marion Armstrong; Major R. St. C. Bethrié (21st Prince Albert's Own Cavalry); Miss Alice M. Burge; Mrs. E. H. Colbeck; Captain W. Kingsmill Cook, I.A.; Miss Alice Cory; Eric Arthur Kaffin Crossfield (10th Gurkha Rifles, I.A.); Alfred Augustus Dowey, M.A.; Mrs. John Hamilton Evans; Miss Mary Hall; Miss Alice Mary Hunt; Joseph Iliffe; Miss Mabel Ingram; Miss Dorothy E. Johnston; Miss Mary S. Johnston; Mrs. Hannah Louisa Lees; Hon. Mrs. St. John Mildmay Russell Hastings Millward; Miss Sophie Nicholls, M.A.; Miss C. A. Raisin; John Hargreaves Robinson; Henri See; Morton Hollinshead Cranford-Stuart; Miss Harriet Helen Tatlock; Græme Douglas Williams; Miss Pauline Willis; Miss Dolf Wyllarde.*

The President gave an address on The Antarctic Disaster (see p. 210).

The paper read was:—

"The Balkan Peninsula." By D. G. Hogarth.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Lunn.**

The Englishman in the Alps; being a collection of English prose and poetry relating to the Alps. Edited by Arnold Lunn. Oxford: University Press, 1913. Size 7 × 4½, pp. xx. and 294. *Price 5s. net. Presented by the Publishers.*

Austria—Bosnia and Herzegovina. **Michel.**

Robert Michel. Fahrten in den Reichslanden: Bilder und Skizzen aus Bosnien und der Hercegovina. Vienna, etc., Deutsch-Österreichischer Verlag, 1912. Size 7½ × 5, pp. 196. *Illustrations. Price 6 kr. Presented by the Publishers.*

Balkan Peninsula. **Muzet.**

Aux pays balkaniques: Monténégro; Serbie; Bulgarie. Par Alphonse Muzet. Paris: P. Roger & Cie., [1912]. Size 8 × 5½, pp. 236. *Sketch-map and Illustrations. Price 4 fr. Presented by the Publishers.*

France. **Jousset.**

P. Jousset. La France: géographie illustrée. 2 vols. Paris: Libr. Larousse, [1912]. Size 13 × 10, pp. (vol. 1) iv. and 390.; (vol. 2) 464. *Maps and Illustrations. Price 56 fr. Presented by the Publishers.*

A profusely illustrated systematic description of France.

France—Auvergne. **Bréhier.**

L'Auvergne: choix de textes précédés d'une étude. Par Louis Bréhier. Paris: Libr. Renouard, 1912. Size 10 × 7, pp. 248. *Map and Illustrations. Price 4s.*

This introduces a series cast on somewhat novel lines. A general description of the region by the editor is followed by an anthology of descriptive passages from various writers.

France—Normandy. **Fossey and Longnon.**

La Haute Normandie. Par J. Fossey et J. Longnon. (Guides artistiques et pittoresques des pays de France.) Paris: Libr. Ch. Delagrave, [1912]. Size 7½ × 4½, pp. vii. and 592. *Maps and Plans. Price 5 fr. 50. Presented by the Publishers.*

France—Pas-de-Calais. **Ardouin-Dumazet.**

Ardouin-Dumazet. Voyage en France. 58 Série: Calaisis, Boulonnais, et Artois. Paris: Berger-Levrault, 1912. Size 7½ × 5, pp. viii. and 352. *Maps and Plans. Price 3 fr. 50.*

Norway—Language. **Thimm and Hanssen.**

Norwegian self-taught, with phonetic pronunciation. By C. A. Thimm; revised and enlarged by P. Th. Hanssen. 5th edit. London: E. Marlborough & Co., 1912. Size 7½ × 5, pp. 128. *Price 2s. 6d. Presented by the Publishers.*

Norway—Railway. *B.S.G. Lille* **58** (1912): 18–30. **Lamotte.**

Voyage en montagne. Nouvelle ligne Bergen-Christiania au point de vue historique et pittoresque. Par R. P. Lamotte.

Portugal—Language. **Cunha.**

Portuguese self-taught (Thimm's system), with phonetic pronunciation. By E. da Cunha. 2nd edit. London: E. Marlborough & Co., 1912. Size 7½ × 5, pp. 120. *Price 2s. 6d. Presented by the Publishers.*

Pyrenees—Routes. **Freeston.**

The passes of the Pyrenees; a practical guide to the mountain roads of the Franco-Spanish frontier. By Charles L. Freeston. London: K. Paul & Co., 1912. Size 8½ × 5½, pp. xiv. and 196. *Sketch-maps and Illustrations. Price 10s. 6d. net.*

Russia—Geology. *Annuaire géol. et min. Russie* **14** (1912): 62–80. **Vassilevsky.**

Explorations géologiques le long des rivières Lovate, Kounia, Bolchoï et Maly Toudre. Par N. J. Wassilewsky. [In Russian: French *résumé*.]

United Kingdom—Cartography. **Newbigin.**

Ordnance Survey maps: their meaning and use: with descriptions of typical

sheets. By Dr. Marion I. Newbigin. London: W. & A. K. Johnston, 1913. Size 6½ × 5, pp. 126. *Maps. Price* 1*s. net. Presented by the Publishers.*

United Kingdom—Chilterns. **Eland.**

The Chilterns and the Vale. By G. Eland. London: Longmans & Co., 1911. Size 8 × 5, pp. xxi. and 170. *Illustrations. Price* 3*s.* 6*d. net.*

United Kingdom—Climatology. *Scottish G. Mag.* **28** (1912): 517–524. **Richardson.**

A comparison of the climate of Edinburgh and Bournemouth. By Ralph Richardson. *Diagrams.*

United Kingdom—Communications. **Pratt.**

A history of inland transport and communication in England. By Edwin A. Pratt. London: K. Paul & Co., 1912. Size 7½ × 5, pp. xii. and 532. *Price* 6*s. net.*

United Kingdom—Cumberland—Glaciation. **Smith.**

Quart. J. Geol. S. **68** (1912): 402–448.

The glaciation of the Black Combe district (Cumberland). By Bernard Smith. *Sketch-map, Sections, and Illustrations.*

See note in the December number, 1912, p. 641.

United Kingdom—Ireland—Archæology. **Windle.**

P.R. Irish A. **30**, Sect. C (1912): 283–306.

On certain megalithic remains immediately surrounding Lough Gur, County Limerick. By Prof. Bertram C. A. Windle. *Sketch-map, Plans, and Illustrations.*

United Kingdom—London—Historical. **Haverfield.**

J. Roman Studies **1** (1912): 141–172.

Roman London. By Prof. F. Haverfield. *Sketch-map, Plans, Sections, and Illustrations.*

United Kingdom—London—Historical. **Stewart.**

Nineteenth Century **72** (1912): 763–782.

A visit to London in the year 1651. By Charles Edward Stewart. *Facsimile.*

United Kingdom—Middlesex. **Bosworth.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Middlesex. By G. F. Bosworth. Cambridge: University Press, 1913. Size 7½ × 5, pp. x. and 166. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Scotland. **Bradley.**

The gateway of Scotland; or East Lothian, Lammermoor, and the Merse. By A. G. Bradley. London: Constable & Co., 1912. Size 9½ × 6, pp. x. and 452, *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Scotland—Geology. **Barrow and others.**

Memoirs of the Geological Survey, Scotland. The geology of the districts of Braemar, Ballater, and Glen Clova. (Explanation of sheet 65.) By George Barrow and E. H. Cunningham, with contributions by L. W. Hinxman. Edinburgh, 1912. Size 10 × 6, pp. vi. and 138. *Illustrations.*

United Kingdom—Surrey. **Whitaker and Mill.**

Memoirs of the Geological Survey. England and Wales. The water supply of Surrey, from underground sources, with records of sinkings and borings. By William Whitaker, with contributions on the rainfall by Dr. Hugh Robert Mill. London: E. Stanford, 1912. Size 10 × 6, pp. vi. and 352. *Sketch-map.*

United Kingdom—Wales—Geology. *Quart. J. Geol. S.* **68** (1912): 328–344. **Jones.**

The geological structure of Central Wales and the adjoining regions. By Prof. Owen Thomas Jones. *Sketch-maps and Sections.*

ASIA.

Armenia—Historical. **Thureau-Dangin.**

Une relation de la huitième campagne de Sargon (714 av. J.-C.). Texte assyrien inédit, publié et traduit par François Thureau-Dangin. Paris: Paul Geuthner, 1912. Size 12½ × 8, pp. xx. and 188. *Map and Facsimiles. Price* 36 *fr. Presented by the Publishers.*

This has a geographical interest in that the course of the Assyrian expedition under Sargon through Armenia and Kurdistan is described with sufficient topographical

details to warrant an attempt to reconstruct the itinerary. This task the editor takes in hand in the introduction.

Asia. **Huntington.**

Asia: a geography reader. By Ellsworth Huntington. Chicago: Rand McNally & Co., [1912]. Size 7½ × 5, pp. xxvi. and 344. *Maps and Illustrations. Presented by the Publishers.*

China—Political. *Nineteenth Century* **72** (1912): 645–664. **Dillon.**

The dismemberment of China. By E. J. Dillon.

Emphasizes the tendency to separation shown by the outlying parts of the empire.

China—Population. *B. American G.S.* **44** (1912): 668–673. **Rockhill.**

The 1910 census of the population of China. By W. W. Rockhill.

The data supplied by Mr. Rockhill were referred to in vol. **40**, p. 69.

China—Yunnan. **Brunhuber.**

An Hinterindiens Riesenströmen. Von Dr. Robert Brunhuber. Berlin: Dr. Franz Ledermann, [1911]. Size 10 × 6½, pp. 120. *Map and Illustrations. Price 3s. 2d.*

The journals of this unfortunate traveller (*Journal*, vol. **34**, p. 608) were saved, and form the basis of the present narrative.

China and Korea. **Madrolle.**

Madrolle's Guide Books. Northern China: the valley of the Blue river; Korea. Paris and London: Hachette & Co., 1912. Size 7 × 5, pp. xxviii. and 472. *Maps and Plans. Price 15s. net. Presented by the Publishers.*

French Indo-China—Tongking—Irrigation. **Chassigneux.**

La G., B.S.G. Paris **26** (1912): 177–202.

L'irrigation dans le delta du Tonkin. Ses conditions géographiques. Par E. Chassigneux. *Sketch-maps.*

India—Himalaya—Historical. **Wessels.**

Antonio de Andrade, S.J. Een ontdekingsreiziger in de Himalaya en in Tibet (1624–1630). Door C. Wessels. (Overgedrukt uit *de Studiën* Tijdschrift voor Godsdienst Wetenschap en Letteren, Deel lxxvii., Afl. No. 4.) Antwerp, 1912. Size 9½ × 6½, pp. 33.

Noticed in vol. **40**, p. 332.

India—Himalaya—Teram Kangri. *Alpine J.* **26** (1912): 307–313. **Longstaff.**

Mr. Collins' Triangulation of Teram Kangri. By T. G. Longstaff. *Sketch-map.*

Cf. Journal, vol. **39**, p. 71.

India—Kumaon—Poting glacier. **Grinlinton.**

Records Geol. Surv. India **42** (1912): 102–126.

Notes on the Poting Glacier, Kumaon Himalaya, June, 1911. By Captain Grinlinton. *Sketch-maps, Sections, Diagrams, and Illustrations.*

India—Nepal. **Brown.**

Picturesque Nepal. By Percy Brown. London: A. & C. Black, 1912. Size 8½ × 5½, pp. xvi. and 206. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

India and Persia—Historical. **Fryer.**

A new account of East India and Persia; being nine years' travels, 1672–1681. By John Fryer. Edited by William Crooke. Vol. 2. (Works issued by the Hakluyt Society, 2nd series, No. 20.) London, 1912. Size 9 × 6, pp. 372. *Purchased.*

Korea. **Griffis.**

A modern pioneer in Korea: the life story of Henry G. Appenzeller. By Dr. W. E. Griffis. New York and London: Fleming H. Revell Co., [1912]. Size 8 × 5, pp. 298. *Illustrations. Price 5s. net.*

Malay Archipelago. *Ts. K. Nederland. Aardr. Genoots.* **29** (1912): 637–654. **Eerde.**

Het onderzoek van den Rindjani en zejne omgeving. Door J. C. van Eerde. *Illustrations.*

A visit by the Sunda Expedition of the Frankfort Geographical Society.

Malay Archipelago—Coral formations. **Niermeyer.**

Ts. K. Nederland. Aardr. Genoots. **29** (1912): 623–636.

Atollen en barrière-riffen in de Oost-Indiese archipel; een antwoord, en een opwekking tot onderzoek. Door J. F. Niermeyer.

Philippines. **Blount.**

The American occupation of the Philippines, 1898–1912. By James H. Blount. New York and London: E. P. Putnam's Sons, 1912. Size 9½ × 6, pp. xxii. and 664. *Map and Illustration. Price* 18*s.*

A valuable account of the whole course of the American occupation by one who himself took part in it, and has been at pains to supplement his own knowledge by reference to official documents.

Russia—Siberia. **Waldburg-Zeil.**

Die Sibirischen Forschungsreisen des Grafen Karl Waldburg-Zeil. Nach seinen hinterlassenen Tagebüchern bearbeitet von Oskar Canstatt. Stuttgart: Deutsche Verlags-Anstalt, 1912. Size 8½ × 5½, pp. 286. *Portrait. Price* 5*s.*

The Count's journeys in Siberia took place some thirty years ago. He also took part in one of the early Swedish expeditions to Spitsbergen.

Russian Turkestan. **Rickmers.**

The Duab of Turkestan: a physiographic sketch and account of some travels. By W. Rickmer Rickmers. Cambridge: University Press, 1913. Size 11 × 7½, pp. xvi. and 564. *Maps and Illustrations. Price* 30*s. net. Presented by the Publishers.*

Siam. **Gerini.**

Siam and its productions, arts, and manufactures. A descriptive catalogue of the Siamese section at the International Exhibition of Industry and Labour held in Turin, 1911. Compiled by Colonel G. E. Gerini. English edition. (Hertford: S. Austin & Sons), 1912. Size 8½ × 5½, pp. lxvi., and 340. *Map, Plan, and Illustrations. Presented by the Publishers.*

Siam. **McGilvary.**

A half-century among the Siamese and the Lão. An autobiography by Dr. Daniel McGilvary. New York and London: Fleming H. Revell Co., [1912]. Size 8½ × 5½, pp. 436. *Maps and Illustrations. Price* 7*s.* 6*d. net.*

Turkey—Mesopotamia—Archæology. **Herzfeld.**

Erster vorläufiger Bericht über die Ausgrabungen von Samarra. Von Ernst Herzfeld. Mit einem Vorwort von Friedrich Sarre. Berlin: D. Reimer, 1912. Size 11½ × 9, pp. xii. and 50. *Sketch-map, Plans, and Illustrations. Price* 3*s.*

Turkey—Syria—Historical. **Lucian and Strong.**

The Syrian goddess; being a translation of Lucian's "De Dea Syria," with a life of Lucian by Prof. Herbert A. Strong; edited by Dr. John Garstang. London: Constable & Co., 1913. Size 7½ × 5, pp. xiv. and 112. *Illustrations. Price* 4*s. net. Presented by the Publishers.*

Western Asia—Historical. **Boucher.**

Colonel Arthur Boucher. L'Anabase de Xénophon (Retraite des dix mille), avec un notice historique et militaire. Paris, etc.: Berger-Levrault, 1913. Size 11 × 8½, pp. l. and 356. *Maps, Plans, and Illustrations. Price* 25 *fr. Presented by the Publishers.*

AFRICA.

British East Africa. **Stigand.**

The land of Zinj; being an account of British East Africa, its ancient history and present inhabitants. By Captain C. H. Stigand. London: Constable & Co., 1913. Size 9 × 5½, pp. xii., and 352. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

Central Africa. **Graetz.**

Im Motorboot quer durch Afrika. Von Paul Graetz. Berlin: Braunbeck und Gutenberg, 1912. Size 8½ × 6, pp. xvi. and 216. *Sketch-maps and Illustrations. Price M.*650. *Presented by the Publishers.*

Describes the author's journey from the Indian ocean by the Zambezi and Lake Nyasa to the continental water-parting, and thence by the Chambezi and Lake Bangweulu to the Luapula, where for the time his navigation ceased (cf. February number, p. 168).

Egypt—Nile Delta—Historical. *J.R. Asiatic S.* (1912): 941–980. **Guest.**

The Delta in the middle ages. A note on the branches of the Nile and the Kurahs of Lower Egypt. By A. R. Guest. *Map.*

French Guinea—Boundaries. *L'Afrique Française* **22** (1912): 335–340. **Terrier.**

Les Frontières de la Guinée Française, de Sierra Leone et du Libéria. Par Auguste Terrier. *Sketch-maps.*

German East Africa. **Hennig.**

Am Tendaguru: Leben und Wirken einer deutschen Forschungs-Expedition zur Ausgrabung vorweltlicher Riesensaurier in Deutsch-Ostafrika. Von Dr. Edw. Hennig. Stuttgart: E. Schweizerbart'sche Verlag, 1912. Size 9 × 6½, pp. 152. *Sketch-map and Illustrations. Price M.4. Presented by the Publishers.*

German East Africa. **Kohlschütter.**

Ergebnisse der Ostafrikanischen Pendel-Expedition der Konigl. Gesellschaft der Wissenschaften zu Göttingen in den Jahren 1899 und 1900, ausgeführt von Hans Glauning und Ernst Kohlschütter. Bearbeitet von Dr. Ernst Kohlschütter. 2 Band: Die astronomisch-geodätischen Beobachtungen. Berlin: Weidmann, 1912. Size 11 × 9, pp. vi. and 102. *Sketch-plans and Diagrams.*

German South-West Africa—Kalahari. **Range.**

T. Geol. S. South Africa **15** (1912): 63–73.

Topography and geology of the German South Kalahari. By Dr. Paul Range. *Sketch-map.*

See January number, p. 68.

Italian Somaliland. **Martino.**

La Somalia Italiana nei tre anni del mio governo. Relazione di Giacomo de Martino. Roma: Carlo Colombo, 1912. Size 12½ × 8½, pp. 212. *Maps, Plans, and Illustrations. Presented by the Author.*

Kamerun. *Deutsches Kolonialblatt* **23** (1912): 860–862. **Tamm.**

Bericht über eine Erkundung des Dume und des Mara. Von Leutnant Tamm. *Map.*

The Dume (of which the Mara is a tributary) flows east to the Kadei (Congo basin).

Nigeria—Mineral Survey. **Dunstan.**

Southern Nigeria. Report on the results of the mineral survey of Southern Nigeria, 1910. By Prof. Wyndham R. Dunstan. (Colonial Reports—Miscellaneous, No. 83, 1912.) London, 1912. Size 9½ × 6, pp. 14.

Portuguese East Africa. *Geol. Mag.* V. **9** (1912): 412–217. **Holmes and Wray.**

Outlines of the geology of Mozambique. By Arthur Holmes and W. A. Wray.

South and East Africa. **Brown.**

The guide to South and East Africa . . . edited annually by A. Samler Brown and G. Gordon Brown. 1913 (19th) edit. London: S. Low & Co., 1913. Size 7½ × 5, pp. liv. and 694. *Maps, Plans, and Illustrations. Price 1s. net. Presented by the Union-Castle Mail S.S. Co.*

This handy guide has now been augmented by the addition of about 200 pages relating to East Africa, while at the same time the price has been reduced to a nominal figure.

Sudan. **Mecklenburg.**

Vom Kongo zum Niger und Nil: Berichte der deutschen Zentralafrika-Expedition 1910–1911. Von Adolf Friedrich Herzog zu Mecklenburg. 2 vols. Leipzig: F. A. Brockhaus, 1912. Size 9½ × 6, pp. (vol. 1) x. and 324; (vol. 2) x. and 398. *Maps and Illustrations. Price M.20. Presented by the Publisher.*

Uganda—Geodesy. **Colonial Survey Committee**

Colonial Survey Committee. Report of the measurement of an arc of meridian in Uganda. Vol. 1. London: Wyman & Sons, 1912. Size 13 × 8½, pp. 60. *Sketch-maps and Diagrams. Price 2s. 6d. Presented by the Colonial Office.*

West Africa—Historical. **Marees.**

Beschryvinghe ende historische verhael van het Gout Koninckrijck van Gunea, anders de Gout-Custe de Mina genaemt, liggende in het deel van Africa. Door P. de Marees; uitgegeven door S. P. l'Honoré Naber. (Werken uitgegeven door de Linschoten-Vereeniging; 5.) The Hague: M. Nijhoff, 1912. Size 10 × 6½, pp. lxxvi. and 314. *Facsimile Map and Illustrations.*

Reprint of a rare Dutch account of the Gold Coast, of the early 17th century.

NORTH AMERICA.

Canada—British Columbia. **Boam and Brown.**

British Columbia: its history, people, commerce, industries, and resources. Compiled by Henry J. Boam; edited by Ashley G. Brown. London: Sells, Ltd., 1912. Size 12½ × 9½, pp. 496. *Maps and Illustrations. Price* £5 5*s. Presented by the Publishers.*

Canada—British Columbia—Survey. **Johnson.**

Min. of P. I. Civil Engineers **188** (1912): 371–379.

The Bear Creek Hydrographic Survey, British Columbia. By Francis Robert Johnson. *Sketch-map.*

Canada—Historical. *B.S.G. Quebec* **6** (1912): 226–230. **Sulte.**

De Montréal au Détroit en 1603. Par Benjamin Sulte.

Canada—Nova Scotia—Geology. *American J. Sc.* **34** (1912): 242–250. **Williams.**

Geology of Arisaig-Antigonish district, Nova Scotia. By Merton Y. Williams.

Costa Rica. *Petermanns M. Ergänzungsheft* No. 175 (1912): pp. 48. **Pittier.**

Kostarika. Beiträge zur Orographie und Hydrographie. Von Prof. Henri F. Pittier. *Map and Illustrations.*

Labrador. *B.S.G. Philadelphia* **11** (1913): 1–15. **Bryant.**

An exploration in South-Eastern Labrador. By Henry G. Bryant. *Illustrations.*

North America—Fauna. **Dugmore.**

Wild life and the camera. By A. Radclyffe Dugmore. London: W. Heinemann, 1912. Size 9 × 6, pp. xii. and 332. *Illustrations. Price* 6*s. net. Presented by the Publisher.*

North America—West Coast. **Sheldon.**

The wilderness of the North Pacific Coast islands: a hunter's experiences while searching for wapiti, bears and caribou on the larger coast islands of British Columbia and Alaska. By Charles Sheldon. London: T. Fisher Unwin, 1912. Size 8½ × 5½, pp. xvi. and 246. *Maps and Illustrations. Price* 8*s.* 6*d.*

United States. **Blackwelder.**

Handbuch d. regionalen Geologie (*Steinmann und Wilckens*) **8** (1912): Heft 11, pp. 258.

United States of North America. By Eliot Blackwelder. *Sketch-maps, Sections and Diagrams.*

United States—Colorado—Glaciation. *J. Geology* **20** (1912): 502–529. **Hole.**

Glaciation in the Telluride Quadrangle, Colorado. By Allen David Hole. *Map and Illustrations.*

United States—Deserts—Phytogeography. **Macdougal.**

Scottish G. Mag. **28** (1912): 449–456.

Some physical and biological features of North American Deserts. By Dr. Daniel Trembly Macdougal.

United States—Historical. **Semple.**

American history and its geographic conditions. By Ellen Churchill Semple. [Re-issue.] London: Constable & Co., 1913. Size 9 × 6, pp. viii. and 466. *Maps. Price* 12*s.* 6*d. net. Presented by the Publishers.*

United States—New York. **Niles.**

The Hoosac valley: its legends and its history. By Grace Greylock Niles. New York and London: G. P. Putnam's Sons, 1912. Size 8½ × 6, pp. xxiv. and 584. *Sketch-maps and Illustrations. Price* 15*s.*

United States—Pennsylvania. *B.S.G. Philadelphia* **11** (1913): 40–44. **Roorbach.**

The prevention of floods at Pittsburgh. By G. B. Roorbach. *Map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine. **Schmidt and Grotewold.**

Argentinien in geographischer, geschichtlicher und wirtschaftlicher Beziehung. Von Wilhelm Schmidt und Dr. Christian Grotewold. Hannover: Hahn, 1912. Size 9½ × 6, pp. xxxii. and 398. *Maps and Illustrations. Price M.*13. *Presented by the Publisher.*

Colombia. **Serret.**

Félix Serret. Voyage en Colombie (1911–1912). Paris: H. Dunod et E. Pinat, 1912. Size 7½ × 5, pp. viii. and 332. *Illustration. Price 3 fr. 50. Presented by the Author.*

Panama Canal. **Johnson.**

Panama Canal traffic and tolls. By Emory R. Johnson. Washington: [U.S. Department of War], 1912. Size 12 × 9, pp. vi. and 490. *Maps and Diagrams. Presented by the Isthmian Canal Commission.*

Paraguay. **Koebel.**

In Jesuit land: the Jesuit missions of Paraguay. By W. H. Koebel. London: S. Paul & Co., [1912]. Size 9 × 5½, pp. 382. *Illustrations. Price 12s. 6d. net.*

Peru. **Erving.**

Medical report of the Yale Peruvian Expedition. By Dr. William G. Erving. (Extract from the *Yale Medical Journal*, vol. 18, April, 1912.) [New Haven, 1913.] Size 9½ × 6, pp. 325–335. *Sketch-map and Illustrations.*

South America—Ethnology. **Hrdlička and others.**

Smithsonian Institution. Bureau of American Ethnology, Bulletin 52. Early man in South America. By Aleš Hrdlička, in collaboration with W. H. Holmes, Bailey Willis, Fred Eugene Wright, and Clarence N. Fenner. Washington, 1912. Size 9½ × 6, pp. xvi. and 406. *Sketch-maps, Illustrations, and Diagram.*

Venezuela. **Ministerio de Fomento.**

Ministerio de Fomento, Dirección General de Estadistica. Anuario Estadistica de Venezuela, 1909. Caracas, 1911. Size 10½ × 7, pp. xxii. and 652. [In Spanish, French, and English.]

AUSTRALASIA AND PACIFIC ISLANDS.

Easter Island. **Knoche.**

Tres notas sobre la Isla de Pascua. I. Observaciones de algunas pinturas, en sus reproducciones. II. Los últimos tatuajes en la Isla de Pascua. III. Un cuento y canciones. Por Walter Knoche. Santiago, 1912. Size 10½ × 7, pp. 28. *Illustrations.*

New South Wales—Minerals. **Carne.**

New South Wales. Department of Mines, Geological Survey. Mineral Resources, No. 16. The antimony-mining industry and the distribution of antimony ores in New South Wales. By J. E. Carne. Sydney, 1912. Size 10 × 6, pp. 54. *Map and Illustrations.*

New South Wales—Surface form. **Jensen.**

J. and P.R.S. New South Wales **45**, 1911 (1912): 337–358.

The nature and origin of gilgai country (with notes on Quaternary climate). By Dr. H. I. Jensen.

See note, *ante*, p. 288.

POLAR REGIONS.

Arctic—Greenland. **Mikkelsen.**

Lost in the Arctic: being the story of the *Alabama* Expedition, 1909–1912. By Ejnar Mikkelsen. London: W. Heinemann, 1913. Size 10 × 7, pp. xviii. and 400. *Map and Illustrations. Price 18s. net. Presented by the Publisher.*

Spitzbergen. **Alexander.**

Skriften Videnskaps-S. Kristiania, Mat.-Naturvid. Kl., 1911 (1912): No. 19, pp. 16.

Observations astronomiques faites au Spitsberg par l'Expédition Isachsen, 1909–1910, et calculées par Anton Alexander.

Spitzbergen—Geology. **Hoel and Holtedahl.**

Skriften Videnskaps-S. Kristiania, Mat.-Naturvid. Kl., 1911 (1912): No. 8, pp. 38.

Les nappes de lave, les volcans et les sources thermales dans les environs de la Baie Wood au Spitsberg. Par A. Hoel et O. Holtedahl. *Sketch-maps, Sections, and Illustration.*

Reference was made to the expedition during which these observations were taken in vol. 39, p. 162.

MATHEMATICAL GEOGRAPHY.

Cartography—Methods. **Deville.**

The copying camera of the Surveyor General's Office. By Dr. E. Deville. Ottawa, 1912. Size 10 × 7, pp. 40. *Illustrations and Diagrams.*

Compass.

The wireless compass. (Extract from the *Marconigraph*, vol. 2, September, 1912.) [London, 1912.] Size 10 × 7½, pp. 204–206. *Diagrams.*

Nautical Almanac. **Brown and Goodwin.**

Brown's Nautical Almanac, Harbour and Dock Guide and Daily Tide Tables for 1913. Edited by James R. Brown, assisted by H. B. Goodwin. London: James Brown & Son, [1912]. Size 8½ × 5½, pp. 614. *Charts.*

Position-determination. *La G., B.S.G. Paris* **26** (1912): 157–176. **Tilho and Troadec.**

La détermination des longitudes en campagne par la télégraphie sans fil. Par Capitaines Tilho et Troadec.

Survey—Photographic. **Weiss.**

Die geschichtliche Entwicklung der Photogrammetrie und die Begründung ihrer Verwendbarkeit fur Mess- und Konstruktionszwecke. Von Max Weiss. Stuttgart: Strecker und Schröder, 1913. Size 11 × 8, pp. viii. and 94. *Illustrations and Diagrams. Price M.12. Presented by the Publishers.*

Survey and Cartography. **Beauregard.**

Guide scientifique du géographe-explorateur. Par P. Crépin de Beauregard. Paris: Gauthier-Villars, 1912. Size 11 × 7½, pp. x. and 250. *Diagrams. Price 8s.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Bodman.**

Das Klima als eine Funktion von Temperatur und Windgeschwindigkeit in ihrer Verbindung. Von Gösta Bodman. *Diagram.*

(In *Wiss. Ergebnisse d. Schwedischen Südpolar-Expedition*, 1901–1903, herausgegeb. von O. Nordenskiöld, Bd. 2, pp. 1–22.)

Geology—Soils. **Woodward.**

The geology of soils and substrata, with special reference to agriculture, estates, and sanitation. By Horace B. Woodward. London: E. Arnold, 1912. Size 7½ × 5, pp. xvi. and 366. *Sections and Illustrations. Price 7s. 6d. net.*

Isostasy. *J. Geology* **20** (1912): 562–578. **Hayford.**

Isostasy, a rejoinder to the article by Harmon Lewis. By John F. Hayford.

Meteorology. **Leyst.**

Luftdruck und Sonnenflecken. Von Prof. Dr. Ernst Leyst. Moscow, 1912. Size 10 × 7, pp. 66.

Meteorology—Forecasting. **Guilbert.**

Nouvelle méthode de prévision du temps. Par Gabriel Guilbert. Paris: Gauthier-Villars, 1909. Size 10 × 6½, pp. xxxviii. and 344. *Sketch-maps. Presented.*

Meteorology and Magnetism. **Meteorological Office.**

Meteorological Office. British Meteorological and Magnetic Year-Book, Part III., Section 2. *Geophysical Journal*, 1911, comprising daily values of the Meteorological and Geophysical Elements observed at the Central Observatory (Kew), Magnetic Observatory (Eskdale), and Western Observatory (Valencia), together with wind components at fixed hours at four anemograph stations of the Meteorological Office. London: Meteorological Office, 1912. Size 12½ × 10, pp. 48. *Price 5s.*

This marks a new departure in the publications of the Office.

Oceanography—Gulf Stream. *National G. Mag.* **23** (1912): 767–778. **Pillsbury.**

The grandest and most mighty terrestrial phenomenon: the Gulf Stream. By John Elliott Pillsbury. *Maps, Diagrams, and Illustrations.*

Oceanography—Salt deposits. **Van't Hoff.**

Untersuchungen über die Bildungsverhältnisse der ozeanischen Salzablagerungen, insbesondere des Stassfurter Salzlagers. Von J. H. van't Hoff. Leipzig: Akademische Verlagsgesellschaft, 1912. Size 10½ × 7, pp. xx. and 374. *Diagrams. Price 16s.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonisation—Penal settlements. **Heindl.**

Meine Reise nach den Strafkolonien. Von Dr. Robert Heindl. Berlin: Ullstein & Co., 1913. Size 9½ × 7, pp. viii. and 470. *Illustrations. Price* 10*s.*

The largest part of the book deals with New Caledonia, but there are sections on the Andamans and other Eastern penal settlements.

Commercial—Railways. *Nineteenth Century* **72** (1912): 558–569. **Johnston.**

Railway projects in Africa and the Near East. By Sir H. H. Johnston. *Sketch-maps.*

History of Navigation—Bibliography. **Admiralty.**

Admiralty Library. Subject Catalogue of printed books. Part I.: Historical section. London, 1912. Size 11 × 8½, pp. 374. *Presented by the Admiralty Library.*

BIOGRAPHY.

Chaillé-Long. **Chaillé-Long.**

My life in four continents. By Colonel Chaillé-Long. 2 vols. London: Hutchinson & Co., 1912. Size 9 × 5½, pp. xxii., iv., and 616. *Portraits, Maps, and Illustrations. Price* 24*s. net.*

Cornish. **Cornish.**

The travels of Ellen Cornish; being the memoir of a pilgrim of science. By Dr. Vaughan Cornish. London: W. J. Hem-Smith, 1913. Size 9 × 7, pp. xvi. and 294. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Milne. *Geol. Mag.* **V. 9 (1912)**: 337–346.

Eminent living geologists. Prof. John Milne, D.SC., F.R.S., F.G.S., Hon. Fellow of King's College, London. By H. W. *Portraits.*

GENERAL.

British Empire—Surveys. **Colonial Survey Committee.**

The Surveys of British Africa, Ceylon, Cyprus, Fiji, Jamaica, Trinidad, British Honduras. The Annual report of the Colonial Survey Committee. Seventh year. To March 31, 1912. (Colonial Reports, Annual No. 730, 1912.) London, 1912. Size 9½ × 6, pp. 62. *Maps. Price* 1*s.* 1*d.*

Catalogue. **War Office.**

Catalogue of the War Office. Part III. Subject-index. Compiled by F. J. Hudleston. London, 1912. Size 10 × 6, pp. iv. and 1962. *Presented by the War Office.*

Owing to the importance attached to topographical headings, this index will be of much use to geographers, although the primary arrangement is alphabetical and not geographical, that is to say, both countries and subjects are included under one alphabet. Thus under "Canada" are to be found only entries dealing with the Dominion in general, while its divisions are dealt with separately in their own place in the alphabet. Within the headings the arrangement is mainly alphabetical under author's name, though in some cases the older has been separated from the newer literature.

Education—Apparatus. **Hale.**

The Kinematograph in school. By H. O. Hale. (Extract from the *School World*, vol. 14, October, 1912.) London, 1912. Size 10½ × 7½, pp. 361–364.

Education—Statistics. *Scottish G. Mag.* **28 (1912)**: 524–534. **Wallis.**

The use of statistics in the teaching of geography. By B. C. Wallis.

Gazetteer. **Heilprin.**

Lippincott's New Gazetteer: a complete pronouncing gazetteer or geographical dictionary of the world. . . . Edited by Angelo Heilprin and Louis Heilprin. With a conspectus of the Thirteenth Census of the United States. London: J. B. Lippincott & Co., 1912. Size 11 × 7½, pp. x. and 2106. *Price* 42*s. net. Presented by the Publishers.*

This standard work, probably the best one-volume Gazetteer now before the public, is too well known to need a special review, more especially as this appears to be a mere re-issue, with the addition mentioned in the title.

Geography—Text-book. **Wagner.**

Lehrbuch der Geographie. Von Hermann Wagner. 9. Auflage (zugleich vierte Auflage der Neubearbeitung des Lehrbuchs der Geographie von Guthe-Wagner). 1 Band. Hannover: Hahn, 1912. Size 9½ × 6, pp. xii. and 1022. *Diagrams. Price M.*16. *Presented by the Publisher.*

Mohammedan Countries—Encyclopedia. **Houtsma and Seligsohn.**

The Encyclopædia of Islam: a dictionary of the geography, ethnography and biography of the Muhammedan peoples. Prepared . . . under the supervision of Dr. M. Th. Houtsma and Dr. M. Seligsohn. [To be published in 45 parts; 16 parts now published.] Leyden (London: Luzac & Co.), 1908 and onwards. Size 10½ × 7. *Plans and Illustrations. Price 3s. 6d. each part.*

An indispensable work of reference for the Mohammedan countries.

Travel—Vocabulary. **Marlborough.**

Marlborough's travellers' practical manual of conversation. No. 2. In English, French, German, and Dutch (Holland and the Rhine). London: E. Marlborough & Co., 1912. Size 6½ × 3½, pp. 144. *Price 1s. 6d. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Balkan Peninsula. **Kiepert.**

Ethnographische Uebersichts-karte des europäischen Orients. Von H. Kiepert. Politische Grenzeinteilung 1912. Scale: 1:3,000,000 or 1 inch to 47·3 stat. miles. Berlin: Dietrich Reimer (Ernst Vohsen), 1912.

This is a general ethnographical map of the Balkan peninsula and parts of the countries to the north as far as lat. 48° 30′, compiled by the late Dr. H. Kiepert in 1867, with political boundaries corrected to 1912.

Belgium—Luxemburg. **Hansen.**

Carte topographique du Grand Duché de Luxembourg par J. Hansen. Scale 1:20,000 or 3·2 inches to 1 stat. mile. Sheets: I. Bellain; II. Weiswampach; III. Asselborn; IV. Heinerscheid; V. Doncols; VI. Eschweiler; VII. Hosingen; VIII. Harlange; IX. Goesdorf; X. Bourscheid; XI. Foubren: XII.–XIII. Perlé; XIV.–XV. Wahl; XVI.–XVII. Berg; XVIII.–XIX. Medernach: XX.–XXI. Berdorf; XXII. Rosport; XXIII.–XXIV. Steinfort; XXV.–XXVI. Kopstal; XXVII.–XXVIII. Bourglinster; XXIX.–XXX. Flaxweiler; XXXI. Mertert XXXII.–XXXIII. Differdange; XXXIV.–XXXV. Dudelange; XXXVI. Dalheim; XXXVII.–XXXVIII. Burmerange; XXXIX. Arlon; XL.–XLI. Longwy. Paris: Erhard Frères, [1912].

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, from January 1 to 31, 1913.

1-inch map:—

England and Wales. 3rd edition, engraved in outline. Sheets 60, 62, 70. *Price 1s. each*

6-inch maps:—

Revised quarter-sheets, with contours in blue. *Price 1s. each.*
Berkshire, 3 sheets. **Cheshire**, 7 sheets. **Hampshire**, 3 sheets. **Lancashire**, 2 sheets. **Sussex**, 12 sheets.

1:2500 scale maps:—

Revised, with houses stippled, and with areas. *Price 3s. each.*
Berkshire, 5 sheets. **Carnarvonshire**, 2 sheets. **Denbighshire**, 30 sheets. **Flintshire**, 5 sheets. **Lancashire**, 5 sheets. **Oxfordshire**, 6 sheets. **Surrey**, 20 sheets. **Yorkshire**, 38 sheets.

(*E. Stanford, Ltd., London Agents.*)

British Isles—Glasgow. **M'Donald.**

The County of the City of Glasgow as divided into Municipal Wards. Compiled

from actual survey. Scale 1 : 12,672 or 5 inches to 1 stat. mile. A. B. M'Donald, M.I.C.E., City Engineer. Glasgow, 1912.

An outline plan in black and white, with the boundaries and names of the municipal wards shown in red. The whole plan is ruled into half-mile squares in black.

British Isles—London. **Stanford.**

Bacon's Large Scale Atlas of London and Suburbs (revised edition), with an alphabetical index of over 20,000 names. New enlarged and improved edition, with additional road maps of the home counties, and a series of thirteen special maps showing the different areas controlled by Government Departments, Local Authorities, and Supply Companies having statutory powers in and around the City and County of London. Edited by William Stanford. London: G. W. Bacon & Co., Ltd., [1913]. *Price 30s. Presented by the Publishers.*

This quarto atlas contains maps of the home counties with main roads coloured, a set of eight small scale maps of London showing special features such as bus and tram routes, boroughs, unions, parliamentary divisions, petty sessions, etc., a plan of Central London on the scale of 9 inches to a mile, and another plan of London and its environs on the scale of 4 inches to a mile, in 35 sheets. There is a good index to streets, public buildings, etc., which, however, is intended to serve also for reference to a larger plan on the scale of 9 inches to the mile, not included in the atlas.

The work of revision seems on the whole to have been carefully carried out. Some of the older plates, such as the county maps, are far from satisfactory, but little fault can be found with the newer ones. The 4-inch-to-the-mile plan should be specially useful for general reference.

Central Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: Nancy; Passau. Berlin: R. Eisenschmidt, 1912. *Price 1.50 M. each sheet.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abteilung der Kgl. Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. (Kupferdruck-Ausgabe.) Sheet 70, Danzig. Berlin: R. Eisenschmidt, 1912. *Price 1.50 M. each sheet.*

AFRICA.

East Africa Protectorate. **Geographical Section, General Staff.**

Africa. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: South A 37–B, Kenya. Compiled 1911. Reproduced and printed for the War Office, at the Ordnance Survey Office, Southampton, 1912. London Agents: E. Stanford, Ltd.; Sifton, Praed & Co.; T. Fisher Unwin. *Price 1s. 6d. net each sheet. Presented by the Director of Military Operations.*

Egyptian Sudan. **Survey Office, Khartum.**

Africa. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Anglo-Egyptian Sudan. Sheets: 66–J, Lower Sobat; 78–C, Akobo; 78–G, Pibor Post; 78–K, J. Kissiangor. Khartum: Survey Office, 1912. *Price 10 P.T. each sheet. Presented by the Director of Surveys, Khartum.*

German South-West Africa. **Kuntz and Rux.**

Das Kaokofeld (Deutsch-Südwestafrika) nach vortrandenem Material und eigenen Aufnahmen von Dipl.-Ing. J. Kuntz. Konstruiert und gezeichnet von W. Rux. Scale 1 : 800,000 or 1 inch to 12·6 stat. miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Band XXV., Karte 2. Berlin: E. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin.*

A map of that part of German South-West Africa immediately south of the Kunene river. Considerable detail is given concerning the physical features of the country, location of minerals, vegetation, available water, fauna, and other information.

Kamerun. **Ledermann and Moisel.**

Vegetationskarte der von dem Botaniker Ledermann durchreisten Gebiete Kameruns. Nach der von M. Moisel bearbeiteten Karte von Kamerun des "Grossen Deutschen Kolonialatlas" gezeichnet von W. Rux. Scale 1 : 1,000,000 or 1 inch to 15·8 stat miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Band XXV., 1912, Karte 3. Berlin: F. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin.*

This map shows, by means of colours, the distribution of vegetation along the route

of the author, which follows generally the direction of the Yola-Cross river boundary from the coast to the Benue river, at a distance varying from about 60 to 70 miles east of the line.

Kamerun. **Moisel.**

Die Regenmesz-Stationen in Kamerun 1911. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Band XXV., 1912, Karte 8. Berlin : E. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin*

Kamerun. **Moisel.**

Karte von Kamerun. Bearbeitet von Max Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: B 4, Kusseri; C 4 Marua; D 2, Schebschi-Gebirge: D 3, Garua; E 3, Ngaundere. Berlin: Dietrich Reimer (Ernst Vohsen), 1912. *Presented by the Publishers.*

Sierra Leone. **Geographical Section, General Staff.**

Africa. Sierra Leone. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Compiled at the War Office from local reconnaissances, 1911. Sheets: North B 28–E and F, Panguma; North G 28–W and X, Ronietta; North 29–S, Panguma. London agents: E. Stanford, Ltd.; Sifton, Praed, & Co.; T. Fisher Unwin. *Price* 1*s.* 6*d. net each sheet. Presented by the Director of Military Operations.*

South Africa. **Sprigade.**

Karte des Deutsch-Portugiesischen Grenzgebiets in Südwestafrika. Bearbeitet unter Leitung von Paul Sprigade von H. Nobiling und W. Rux. Das portugiesische Gebiet auf Grundlage einer Bearbeitung von Dr. Max Groll. Blatt 1. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Band XXV., 1912, Karte 9. Berlin: E. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin.*

The region included in this map extends from lat. 15° to 19° S., and from long. 11° 20′ to 15° 15′ E. It is a useful general map, compiled chiefly from route surveys of recent date, with the routes shown and the travellers' names written against them.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Mineral Map. Scale 1 : 6,336,000 or 1 inch to 100 stat. miles. Ottawa: Department of the Interior, 1911.

The mineral information has been corrected to date by the Geological Survey of Canada.

Canada. **Department of Militia and Defence, Ottawa.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Sheets: 33, Hamilton, Ontario; 45, Romney, Ontario. Published by the Geographical Section, General Staff. London agents: E. Stanford, Ltd.: Sefton Præd & Co.: T. Fisher Unwin. *Price* 2*s. net each sheet. Presented by the Director of Military Operations.*

Canada. **Wheeler.**

Topographical map showing Mount Robson and mountains of the continental divide north of Yellowhead pass, to accompany the reports of the Alpine Club of Canada's expedition, 1911. From photographic surveys by Arthur O. Wheeler, A.C.C., Director. Scale 1 : 126,720 or 1 inch to 2 stat. miles. Banff: Alpine Club of Canada, 1912. *Presented by A. O. Wheeler, Esq.*

To a great extent this map covers the same area as that of Prof. Norman Collie, which was published in the *Geographical Journal* for March last; but parts that are shown as unexplored in that map have now been mapped by Mr. Wheeler for the first time, and others that were but roughly sketched, have been accurately filled in. The map is interesting as a specimen of photographic survey work, and the positions occupied by the camera and theodolite are indicated.

Canada. **Department of Mines, Geological Survey of Canada.**

British Columbia. Scale 1 : 253,440 or 1 inch to 4 stat. miles. Topographical Map 19A, Lardeau, West Kootenay. Scale 1 : 62,500 or 1·01 inch to 1 stat. mile. Topographical map 20A, Victoria, Vancouver Island; 21A, Saanich, Vancouver Island; 36A, Beaverdell, Yale District. Scale 1 : 4,800 or 11·2 inches to 1 stat. mile. Ottawa: Department of Mines, Geological Survey, 1911. *Presented by the Geological Survey of Canada.*

Chile. **Direccion de Obras Publicas, Santiago.**

Carta Jeografica y Minera de los 29° 30′ a 31° 30′ de Lat. Sur. que comprende la Provincia de Coquimbo. Construida por el Personal de la Inspeccion Jeneral de Jeografia i Minas de la Direccion de Obras Publicas. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Santiago: José del C. Fuenzalida, 1912.

A map of the part of Chile between 29° 30′ and 31° 30′ S. lat., based upon the latest surveys, and showing the location of minerals by means of various symbols. Relief of land is shown by colour tinting in the layer system, superimposed upon hill shading. Railways and roads are shown, and the map is clearly drawn and printed in colours.

PACIFIC OCEAN AND ISLANDS.

Bismarck Archipelago. **Friederici.**

Sprachenkarte von Neu-Mecklenburg u. d. Nachbargebieten. Entworfen von Dr. Georg Friederici, 1910. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Erganzungsheft No. 5, 1912. Berlin: E. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin.*

New Guinea. **Moisel.**

Die Südostecke von Kaiser-Wilhelmsland. Nach den astronom. Ortsbestimmungen u. Vermessungen der Kommissare der deutsch-englischen Grenzexpedition (1908–1909) M. Sabine, Hauptm, Foerster, Bergassessor Stollé, den Wegeaunahmen des Landmessers Wernicke u. Stationsleiters Kling und der Deutchen Admiralitätskarte, No. 515, bearbeitet von M. Moisel gezeichnet von H. Ketzer. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. *Mitteilungen a. d. deutschen Schutzgebieten*, Band XXV., 1912, Karte 5. Berlin: E. S. Mittler & Sohn, 1912. *Presented by Messrs. Dietrich Reimer, Berlin.*

Shows the mapping of the boundary-line between the British and German territories along the 8° parallel of south latitude from the east coast to the 147° meridian, and the territory immediately to the north and west.

GENERAL.

World. **Groll.**

Der Atlantische Ozean. Der Indische Ozean. Der Stille Ozean. Gezeichnet von Dr. M. Groll. Scale 1 : 40,000,000 or 1 inch to 631·3 stat. miles. *Veröffentlichungen d. Instituts f. Meereskunde.* Neue Folge, A. Heft 2. Berlin, 1912. *Presented by Prof. Dr. Albrecht Penck, Director, Institut für Meereskunde der Universität, Berlin.*

Three useful general charts of the Atlantic, Pacific, and Indian oceans, showing depths on the layer system by tints of blue and purple, with numerous soundings in figures. The charts of the Pacific and Indian oceans are on Lambert's equal-area azimuthal projection, while that of the Atlantic, which includes both North and South Atlantic and the Polar regions, is on Lambert's cylindrical equal-area projection.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from January 1 to February 1, 1913. *Presented by the Hydrographer, Admiralty.*

New Charts—

No.			
3740	British islands and adjacent waters:—Mean direction of the tidal streams, also the spring and neap rate in knots at	H.W. at Dover.	Price 6*d.* each sheet. Bound together in an atlas, 7*s.* 6*d.*
3741		1 hour after H.W. at Dover.	
3742		2 hours after H.W. at Dover.	
3743		3 hours after H.W. at Dover.	
3744		4 hours after H.W. at Dover.	
3745		5 hours after H.W. at Dover.	
3746		6 hours after H.W. at Dover.	
3747		5 hours before H.W. at Dover.	
3748		4 hours before H.W. at Dover.	
3749		3 hours before H.W. at Dover.	
3750		2 hours before H.W. at Dover.	
3751		1 hour before H.W. at Dover.	

Note.—These charts embody in a more condensed form the information contained in the following atlases: Tidal streams, English and Irish channels; Tidal streams, North sea; Tidal streams, coasts of Scotland; Tidal streams, Channel islands.

1172, Africa, west coast: Cestos bay to Grand Butu point, 3*s*.

New Editions—2631, England, south coast: Portsmouth harbour, 5*s*. 394, England, south coast: Spithead, 3*s*. 1094, England, east coast: Outer Gabbard to Outer Dowsing, 3*s*. 1415, Ireland, east coast: Dublin bay, 3*s*. 2184, Ireland, south-west coast, including Crookhaven, 3*s*. 2150, Baltic: Geidser odde to Bornholm, 3*s*. 1780, Mediterranean: Gulfs of Lyons and Genoa, 4*s*. 204, Mediterranean, Italy: Gallipoli harbour, 1*s*. 2573, Mediterranean, Egypt: Damietta to El Arish, 3*s*. 2517, Nova Scotia: Green island to Cape Canso, 3*s*. 3096, United States, east coast: Cape Cod bay, 3*s*. 472, Harbours and anchorages on the coast of Haiti and Santo Domingo: Mole of St. Nicholas, Cayemites and Baradaires bays, island of Navassa, Acul bay, bay and harbour of Port au Prince, bay of St. Mark. Port Plata, Santo Domingo harbour, Port Plata (new plans of Aquin and English bays on this sheet), 3*s*. 2821, West Indies: island of Grenada (Plans: St. George harbour, north-east point of Grenada, and adjacent islands, part of the south coast of Grenada), 4*s*. 229, United States, west coast: Point Pinos to Bodega head, 3*s*. 1653, Eastern Archipelago: island of Java (western portion), 5*s*. 1761, China, east coast: Ockseu islands to Tung yung, including the north part of Formosa from Nan sa sha river to Ke lung harbour, 3*s*. 769, Pacific ocean: Admiralty and Hermit islands (Plans: Nares harbour, Alacrity (East) harbour, St. Andrew anchorage, Carola bay), 2*s*.

(*J. D. Potter, Agent.*)

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, February, 1913. London: Meteorological Office, 1913. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, February, 1913. London: Meteorological Office, 1913. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, February, 1913. Washington: U.S. Hydrographic Office, 1913. *Presented by the U.S. Hydrographic Office.*

Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, March, 1913. Ditto, South Pacific Ocean, March, April, and May, 1913. Washington: U.S. Hydrographic Office, 1913. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS AND SKETCHES.

British Columbia. **Hudson.**

Four photographs of Kelowna, British Columbia, taken by Mr. G. H. E. Hudson. *Presented by Sir William Willcocks,* K.C.M.G.

Sir William Willcocks visited British Columbia last year to investigate the irrigation systems of the country, and it was during this visit that these photographs were obtained. They are specially good, and characteristic of the subjects represented. Each photograph measures $9\frac{1}{2} \times 7\frac{1}{2}$ inches.

(1) Mr. Sam Long's orchard; (2) System of irrigating trees; (3) Harvesting tobacco which has been grown with irrigation; (4) An avenue of cherry blossoms.

Jan Mayen. **Charcot.**

Ninety-three photographs of Jan Mayen taken by Dr. J. B. Charcot during 1902 and 1912. *Presented by Dr. J. B. Charcot.*

A set of specially clear little photographs taken with a folding pocket Kodak during Dr. Charcot's visits to the island in 1902 and 1912. They include views from all sides of the island, and in the album in which they are mounted is a chart, so that the point where each photograph was taken can be identified.

(1) The *Pourquoi Pas?* outward bound, 1912; (2) First glimpse of Jan Mayen; (3–8) South coast between South cape and Wood bay; (9) Wood bay; (10) Summit of Egg island; (11) Wood bay; (12) Beach of Wood bay; (13) Wood bay and Mount Wild; (14) South lake and Cape Trail; (15) At the foot of the mountains; (16) Blocks of lava; (17) The pass leading to Maxy Muso bay; (18) The Austrian station seen from the top of the pass; (19) The *Pourquoi Pas?* before Egg island; (20) The summit of Egg island seen from south-west; (21–23) Egg island and Beerenberg; (24) The

crater, Egg island; (25) Landing in the crater; (26 and 27) In the crater; (28 and 29) Snow in the crater; (30) Beerenberg seen from Wood bay; (31 and 32) Between Capes Fishburn and South-East; (34) Taking the height of Beerenberg; (34) Preparing to sound; (35) Taking in the dredge; (36) Between Capes Fishburn and South-East; (37) Beerenberg bearing north; (38) Beerenberg; (39) Cape South-East; (40) A landslip between Capes South-East and Neill; (41) Waterfall; (42) Beerenberg seen behind Cape Neill; (43) Petersen glacier; (44) Wille glacier; (45) Panorama of Jan Mayen; (46–49) Wille and Greig glaciers; (50 and 51) Cape East; (52) Beerenberg bearing south; (53) Cape North-East; (54 and 55) Swend Foyn glacier; (56) Beerenberg in the fog; (57) Birds; (58 and 59) Beerenberg, fog clearing; (60 and 61) Weyprecht glacier; (62) The staff of the *Pourquoi Pas?*; (63) Approaching Bird mountain; (64 and 65) Bird mountain from the sea; (66 and 67) Mary Muss bay; (68) Bird mountain seen from Mary Muss roads; (69) Bird mountain seen from the beach; (70) Log wood and an Austrian barge; (71) Mary Muss beach; (72) Log wood, Mary Muss beach; (73) The Austrian station; (74) Log wood and whale bones; (75 and 77) The Austrian station; (78 and 79) The Austrian sailor's grave; (80–82) On the way to the North lake; (83) The North lake; (84–86) The Tour de Brielle; (87) Morses bay; (88) English bay; (89) South peak; (90) Cape South-West; (91) Jan Mayen seen from the south; (92) Homeward bound; (93) Ice on the way back.

Labrador. **Hutton.**

Twenty-two photographs of Eskimos and Eskimo summer life in Labrador, taken by Samuel K. Hutton, Esq., M.B. *Presented by Samuel K. Hutton, Esq.*, M.B.

An excellent set of stereoscopic photographs of Eskimo types.

(1 and 2) Eskimo girl (age 8); (3 and 4) Eskimo woman (age 30); (5 and 6) Eskimo women (age 62); (7 and 8) Eskimo boy (age 10); (9 and 10) Eskimo man (age 40); (11 and 12) Eskimo man (age 60); (13 and 14) Eskimo mother and children; (15) Dried salt codfish, the staple summer industry of Labrador; (16) Eskimo boy with dried fish; (17 and 18) An ancient Eskimo tomb, near Okak; (19) An Eskimo kajak on the beach; (20) An Okak Eskimo with his wife and son, with salt fish hung to-day; (21) Eskimo drying fish; (22) An Eskimo summer tent.

Panama. **Pennell.**

Joseph Pennell's Pictures of the Panama canal. Reproductions of a series of lithographs made by him on the Isthmus of Panama, January—March, 1912, together with impressions and notes by the artist. London: William Heinemann, 1912. *Presented by the Publisher.*

A series of twenty-eight black and white lithographs from sketches made by Mr. Pennell during his visit to the canal last year. They give an excellent idea of the gigantic nature of the undertaking and the condition of the works in progress as he saw them. Each sketch is accompanied by a brief description, and at the commencement is a general introductory chapter. The following are the titles of the sketches:—

(1) Colon, the American quarter; (2) Mount Hope; (3) Gatun, dinner-time; (4) At the bottom of Gatun lock; (5) The Guard Gate, Gatun; (6) Approaches to Gatun lock; (7) End of the day, Gatun lock; (8) The jungle, the old railroad from the new; (9) The native village; (10) The American village; (11) The Cut at Bas Obispo; (12) In the Cut at Las Cassadas; (13) The Cut from Culebra; (14) Steam shovel at work in the Culebra Cut; (15) The Cut, looking towards Culebra; (16) The Cut at Paraiso; (17) The Cut looking towards Ancon hill; (18) Laying the floor of Pedro Miguel lock; (19) The gates of Pedro Miguel; (20) The walls of Pedro Miguel; (21) Building Miraflores lock; (22) Cranes, Miraflores lock; (23) Walls of Miraflores lock; (24) Official Ancon; (25) From Ancon hill; (26) The Cathedral, Panama; (27) The city of Panama from the Tivoli hotel, Ancon; (28) The mouth of the canal from the sea.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.